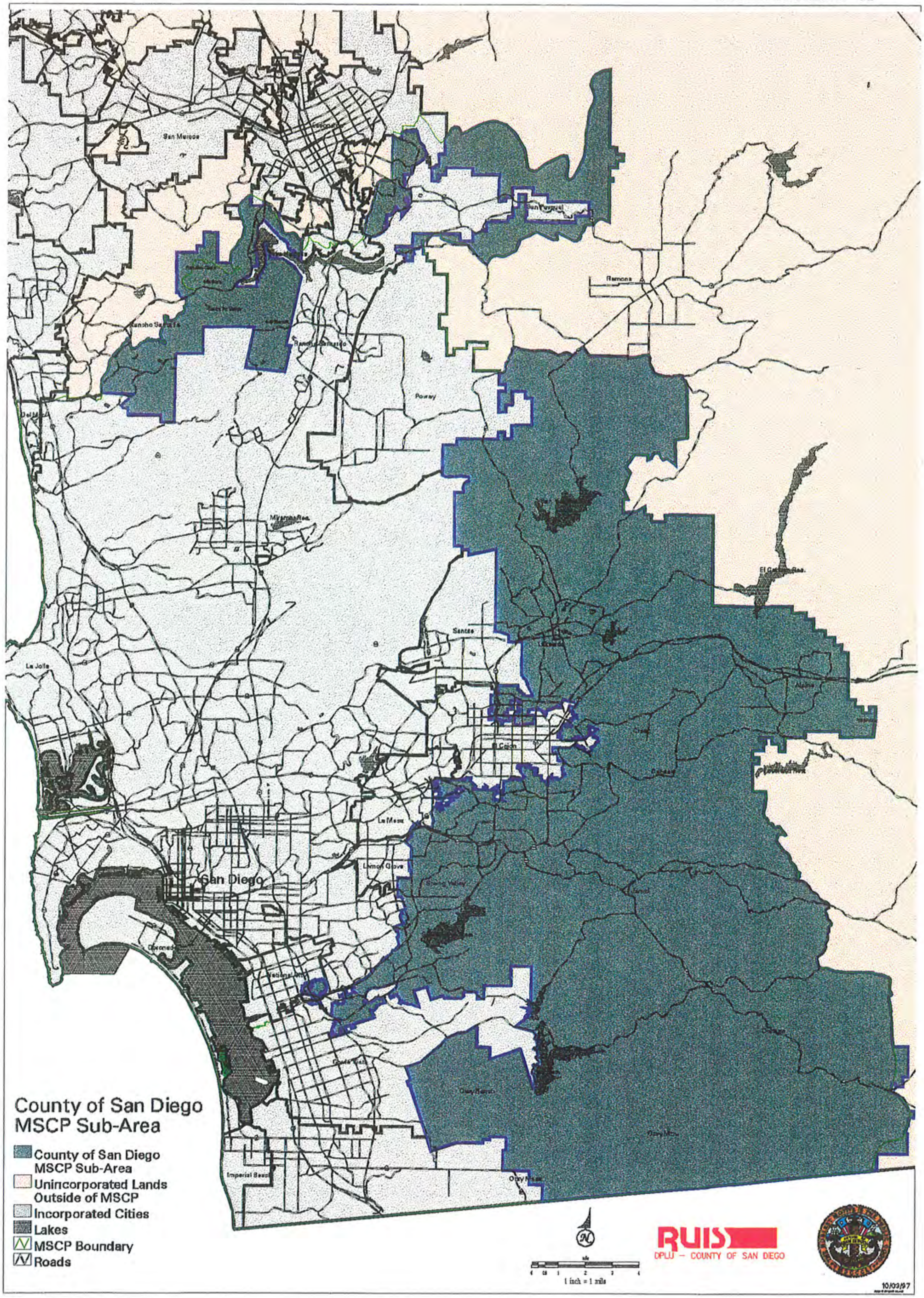
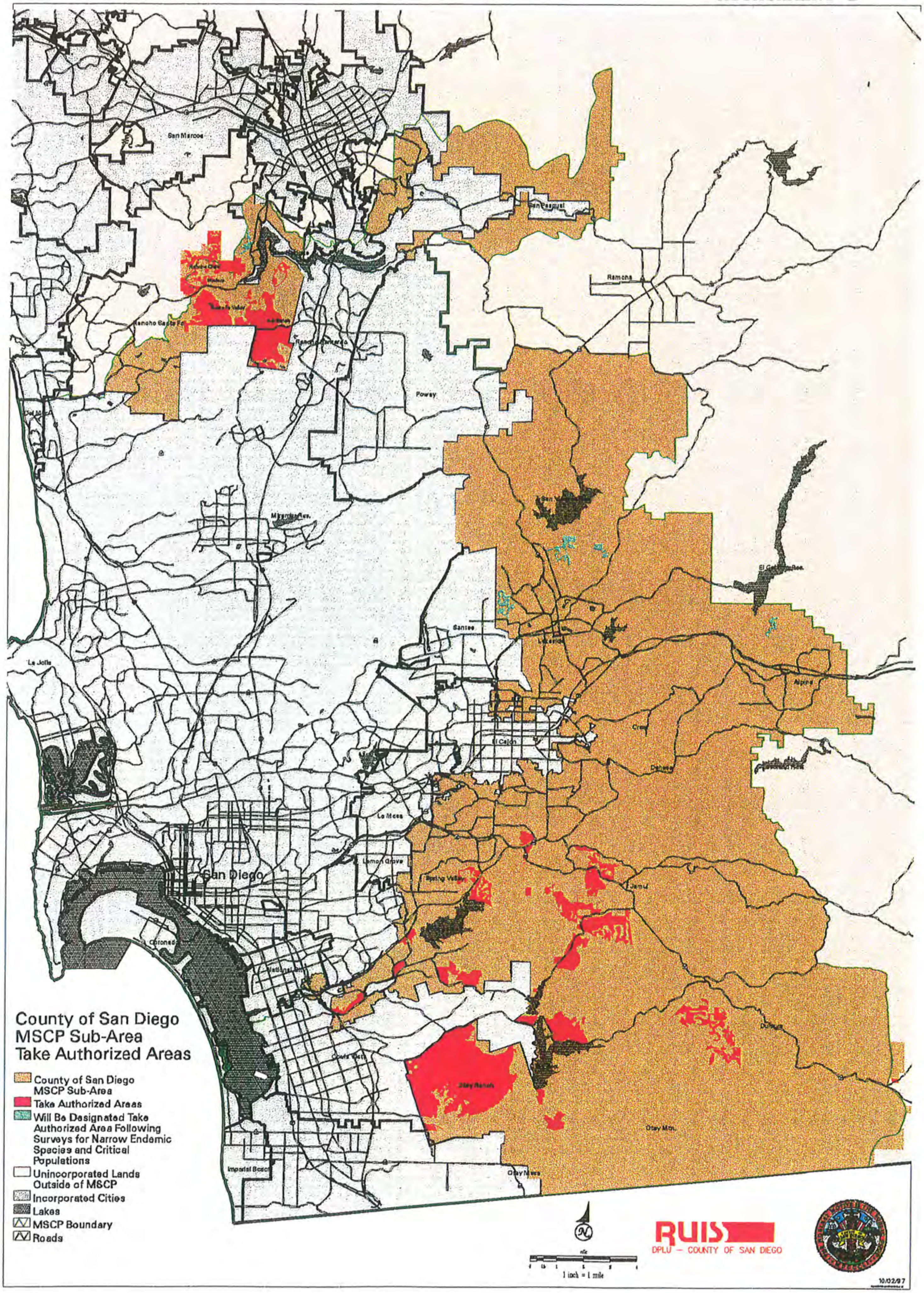
ATTACHMENT A





San Marcos
Ramona
Poway
Santee
La Jolla
El Cajon
La Mesa
Lemon Grove
San Diego
Spring Valley
Jamul
Alpine
Otay Ranch
Otay Mtn.
Imperial Beach
County of San Diego
MSCP Sub-Area
Take Authorized Areas
County of San Diego MSCP Sub-Area
Take Authorized Areas
Will Be Designated Take Authorized Area Following Surveys for Narrow Endemic Species and Critical Populations
Unincorporated Lands Outside of MSCP
Incorporated Cities
Lakes
MSCP Boundary
Roads
RUIS
DPLU – COUNTY OF SAN DIEGO
1 inch = 1 mile
10/02/97

ATTACHMENT C

LIST OF CRITICAL POPULATIONS OF SENSITIVE PLANT SPECIES WITHIN THE MSCP SUBAREA

Species	Critical Population(s)
Dean's milk-vetch	Sweetwater River (north area), Singing Hills, Sloane Canyon
Orcutt's Brodiea	North of San Vicente Reservoir
Slender-pod jewelflower	Wildcat Canyon, Poway/Sanrex, Fortuna Mountain, Dehesa (North of River)
Felt-leaved monardella	Sequan Peak, Iron Mountain
Gander's Butterweed	El Cajon Mountain (between El Capitan and San Vicente Reservoir)
Narrow-leaved nightshade	Silverwood, Fernbrook (near Mussey Grade Road)
Parry's tetracoccus	Dehesa

A map depicting the locations of Critical Populations shown on this attachment is on file with the County at the Department of Planning and Land Use, 5201 Ruffin Road, San Diego, California 92123.

ATTACHMENT D

RARE, NARROW ENDEMIC ANIMAL SPECIES KNOWN FROM SAN DIEGO COUNTY WITHIN THE MSCP SUBAREA*

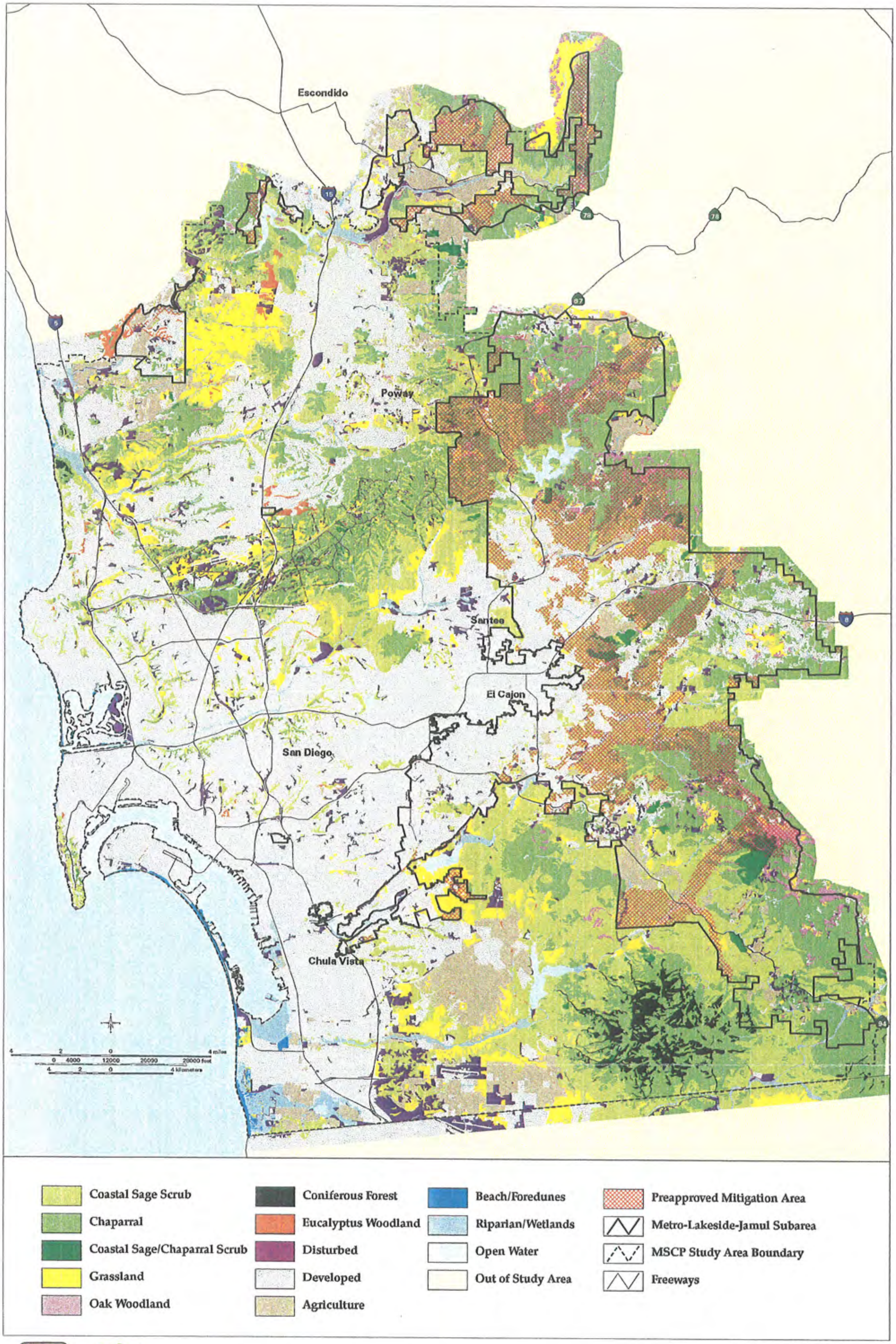
Specific name	Common name	Status
Mammals:		
Perognathus longimembris pacificus	Pacific pocket mouse	FE, SSC
Birds:		
Aquila chrysaetos	golden eagle (nesting)	SSC
Falco peregrinus anatum	American peregrine falcon	CE, FE
Sterna antillarum browni	California least tern	CE, FE
Passerculus Sandwichensis Beldingi	Belding's savannah sparrow	CE
Rallus longirostris levipes	light-footed clapper rail	CE, FE
Laterallus jamaicensis coturniculus	California black rail	CT
Coccyzus americanus occidentalis	western yellow-billed cuckoo	CE
Empidonax traillí extimus	southwestern willow flycatcher	CE, FE
Campylorhynchus brunneicapillus couesi	coastal cactus wren	SSC
Vireo belli pusillus	least Bell's Vireo	FE, CE
Speotyto cunicularia hypugaea	burrowing owl	SSC
Reptiles:		
Clemmys marmorata pallida	southwestern pond turtle	SSC
Amphibians:		
Bufo microscaphus californicus	arroyo southwestern toad	FE, SSC
Rana aurora draytoni	California red-legged frog	FT, SSC
Fishes:		
Eucyclogobious newberryi	tidewater goby	FE, SSC
Invertebrates:		
Branchinecta sandiegoensis	San Diego fairy shrimp	FE
Streptocephalus wootoni	Riverside fairy shrimp	FE

ATTACHMENT E

LIST OF NARROW ENDEMIC PLANT SPECIES WITHIN THE MSCP SUBAREA*

Scientific Name	Common Name	Known from Metro-Lakeside-Jamul
Acanthomintha ilicifolia	San Diego thorn-mint	yes
Agave shawii	Shaw's agave	
Ambrosia pumila	San Diego ambrosia	yes
Baccharis vanessae	Encinitas baccharis	yes
Brodiaea filifolia	thread-leaved brodiaea	
Calochortus dunnii	Dunn's mariposa lily	
Ceonothus cyaneus	Lakeside ceanothus	yes
Dudleya brevifolia	short-leaved dudleya	
Dudleya variegata	variegated dudleya	yes
Ericameria palmeri ssp. *palmeri*	Palmer's ericameria	yes
Hemizonia conjugens	Otay tarplant	
Lepechinia cardiophylla	heart-leaved pitcher sage	yes
Lepechinia ganderi	Gander's pitcher sage	
Mahonia nevinii	Nevin's barberry	not known
Monardella linoides ssp. *viminea*	willowy monardella	
Nolina interrata	Dehesa bear grass	yes
Opuntia parryi var. *serpentina*	snake cholla	

*See Attachment A, MSCP Boundary Map



ATTACHMENT F

Figure 1. Wildlife Agency Preapproved Mitigation Area

Data courtesy of SANDAG

November 4, 1997

ATTACHMENT G

PRESERVE DESIGN CRITERIA

General goals on both a project-by-project basis and for the Segment as a whole are to do the following:

1) Acknowledge the no-net-loss-of-wetlands standard that individual projects must meet to satisfy state and federal wetland goals, policies, and standards and implement applicable County ordinances with regards to wetland mitigation;

2) Include measures to maximize the habitat structural diversity of conserved habitat areas, including conservation of unique habitats and habitat features (e.g., soil types, rock outcrops, drainages, host plants);

3) Provide for the conservation of spatially representative (e.g., north of I-8 vs. south of I-8) examples of extensive patches of coastal sage scrub and other habitat types that were ranked as having high and very high biological value by the MSCP habitat evaluation model;

4) Create significant blocks of habitat to reduce edge effects and maximize the ratio of surface area to the perimeter of conserved habitats using the criteria set out in Chapter 6, Section 6.2.3 of the MSCP Plan. Potential impacts from new development on biological resources within the preserve that should be considered in the design of any project include access, nonnative predators, nonnative species, illumination, drain water (point source), urban runoff (non-point source), and noise. County staff shall determine specific measures necessary to contain impacts from a new development project, and thereby avoid, reduce or mitigate edge effects on the preserve to less than significant levels.

5) Provide incentives for development in the least sensitive habitat areas;

6) Minimize impacts to narrow endemic species and avoid impacts to core populations of narrow endemic species;

7) Preserve the biological integrity of linkages between Biological Resource Core Area; and

8) Achieve the conservation goals for covered species and habitats.

ATTACHMENT H

DESIGN CRITERIA FOR LINKAGES AND CORRIDORS

The following are the design criteria to protect the biological values of regional linkages and corridors:

(1) Habitat linkages as defined by the Biological Mitigation Ordinance, rather than just corridors, will be maintained.

(2) Existing movement corridors within linkages will be identified and maintained.

(3) Corridors with good vegetative and/or topographic cover will be protected.

(4) Regional linkages that accommodate travel for a wide range of wildlife species, especially those linkages that support resident populations of wildlife, will be selected.

(5) The width of a linkage will be based on the biological information for the target species, the quality of the habitat within and adjacent to the corridor, topography, and adjacent land uses. Where there is limited topographic relief, the corridor must be well vegetated and adequately buffered from adjacent development.

(6) If a corridor is relatively long, it must be wide enough for animals to hide in during the day. Generally, wide linkages are better than narrow ones. If narrow corridors are unavoidable, they should be relatively short. If the minimum width of a corridor is 400 feet, it should be no longer than 500 feet. A width of greater than 1,000 feet is recommended for large mammals and birds. Corridors for bobcats, deer, and other large animals should reach rim-to-rim along drainages, especially if the topography is steep.

(7) Visual continuity (i.e., long lines-of-sight) will be provided within movement corridors. This makes it more likely that the animals will keep moving through it. Developments along the rim of a canyon used as a corridor should be set back from the canyon rim and screened to minimize their visual impact.

(8) Corridors with low levels of human disturbance, especially at night, will be selected. This includes maintaining low noise levels and limiting artificial lighting.

(9) Barriers, such as roads, will be minimized. Roads that cross corridors should have 10-foot high fencing that channels wildlife to underpasses located away from

interchanges. The length-to-width ratio for wildlife underpasses is less than 2, although this restriction can be relaxed for underpasses with a height of greater than 30 feet.

(10) Where possible at wildlife crossings, road bridges for the vehicular traffic rather than tunnels for wildlife use will be employed. Box culverts will only be used when they can achieve the wildlife crossing/movement goals for a specific location. Crossings will be designed as follows: sound insulation materials will be provided; the substrate will be left in a natural condition, and vegetated with native vegetation if possible; a line-of-sight to the other end will be provided; and, if necessary, low-level illumination will be installed in the tunnel.

(11) If continuous corridors do not exist, archipelago (or stepping-stone) corridors may be used for short distances. For example, the gnatcatcher may use disjunct patches of sage scrub for dispersal if the distance involved is under 1-2 miles.

ATTACHMENT I

Population Viability Analysis for the California Gnatcatcher within the MSCP Study Area

Prepared for:

The Clean Water Program
City of San Diego

Prepared by:

Patrick J. Mock, Ph.D.
Senior Wildlife Biologist
Biological Resources Group
Ogden Environmental and Energy Services Co., Inc.
5510 Morehouse Drive
San Diego, CA 92121

Project No. 110921000

March 1992
Revised February 1993

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ACKNOWLEDGEMENTS

The author was assisted by members of Ogden's Biological Resources and Environmental Assessment groups, including Jerre Stallcup, Mike White, Steve Lacy, Pat Atchison, Tom McDowell, Rick Ayres, Mary Grishaver, Kris Preston, Dave King, Rick Bailey, and John Lovio. Doug Bolger made significant contributions to an early draft. The Biological Task Force provided valuable input into formulation of potential reserve designs. Technical review of the draft document was provided by Jon Atwood, Marybeth Buechner, Kimball Garrett, Mike Gilpin, Barbara Kus, Reed Noss, John Rotenberry, J. M. Scott, Bill Wagner, and staff of USFWS, Carlsbad .

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1.0 INTRODUCTION

Two types of ecological analyses, denoted by the acronyms PVA and MVP, have become central to sensitive species evaluations in recent years. The objective of a PVA, or population viability analysis, is to identify all threats, natural and human-caused, to a population and determine if these threats endanger the continued existence of the population. An MVP, or minimum viable population, is the smallest population that has a specified probability of remaining extant (not going extinct) within a specified period of time. For example, one might wish to determine the population size necessary to maintain a population with 95% probability over 200 years. The term viability refers to the ability of a population to persist, and is the converse of vulnerability, or the propensity of a population to go extinct. Virtually all aspects of the biology of a species must be considered in determining the actual viability of a real population. It is widely appreciated by biologists that larger populations are more viable than smaller populations, but actually predicting the viability of a given population is a difficult and uncertain undertaking. The following sections discuss the status, biology, and threats to the California gnatcatcher within the Multiple Species Conservation Program (MSCP) study area and present a computer simulation model to evaluate alternative reserve designs for this metapopulation.

2.0 BACKGROUND

2.1 DECLINE IN POPULATION OF THE CALIFORNIA GNATCATCHER

The California gnatcatcher (*Polioptila californica californica*) is one of three recognized subspecies within the species *Polioptila californica* (Atwood 1991). This small songbird was previously a widespread resident of coastal sage scrub (CSS) habitats in much of southern California and northern Baja California. The subspecies was recorded from coastal areas of southern Ventura County to approximately 30° N latitude in Baja California. Eastern limits of the species' United States distribution historically were the most western portions of San Bernardino and Riverside counties. The interior distributional limits of *P.c. californica* in northern Baja California are not accurately known, but it is believed to be limited primarily to a relatively narrow band of suitable habitat along the coast below elevations of 250 meters (Atwood 1991, Atwood and Bolsinger 1992).

The distribution and relative abundance of California gnatcatchers appear to have been patchy and highly localized even prior to the extensive changes in land use during the past ninety years. Grinnell (1898) found gnatcatchers to be "numerous" in the San Fernando Valley and about Pomona and Claremont, but gnatcatchers were not detected between these two localities (i.e., near Pasadena), although suitable habitat apparently was present. This patchy distributional pattern has been accentuated by the agricultural and urban development of southern California. By 1944, Grinnell and Miller noted that suitable habitat for *P.c. californica* had been "somewhat reduced." Pyle and Small (1961) and McCaskie and Pugh (1964) considered the species rare and attributed the lack of recent sightings in historically occupied areas to loss of habitat. Atwood (1980) conducted an extensive, although not exhaustive, survey of the species' status and reported to the California Department of Fish and Game (CDFG) that continued loss of already limited habitat warranted an immediate concern for the subspecies within the United States.

Population declines have been most evident in the three northern counties of the species' historical distribution. Gnatcatchers apparently have been extirpated from Ventura and San Bernardino counties, and a single remnant population is known on the Palos Verdes Peninsula in Los Angeles County. Other small remnant populations may still exist near Azusa, Tujunga, and Claremont, where relatively recent sightings (1960-1984) were documented (Atwood 1990). The most substantial U.S. populations of California gnatcatchers currently occur in Orange, Riverside, and San Diego counties.

No population estimate of the total number of breeding pairs extant in the early twentieth century is available. Atwood (1980) estimated between 1000 and 2000 breeding pairs remained in the United States. In a more detailed population assessment, Atwood (1990) made a "best-case" estimate of 1200 to 2000 breeding pairs based on a rough analysis of areas with moderate habitat potential. The U.S. Fish and Wildlife Service (USFWS) population estimate is 1800 to 2300 pairs, with 770 to 960 pairs in San Diego County (USFWS 1991). Nearly 1,700 geographically distinct gnatcatcher localities are recorded within the MSCP study area in Ogden's regional database. Based on the distribution of habitat and recent gnatcatcher sightings, Ogden estimates the gnatcatcher population within the MSCP study area likely exceeds 900 pairs. This is a conservative estimate since a substantial portion of the MSCP study area has not yet been adequately surveyed for gnatcatchers.

The decline of the California gnatcatcher is primarily attributed to the reduction of CSS habitat throughout the range of the subspecies. Loss, degradation, and fragmentation of CSS habitat have occurred as the result of agricultural and urban development in southern California and northern Baja California (O'Leary 1990). The USFWS has estimated that CSS habitat has been reduced by 70 to 90 percent of its historical extent (USFWS 1991). In addition to habitat loss and degradation, potential adverse effects of brown-headed cowbird brood parasitism and human-subsidized predators (e.g., domestic cats) on the reproductive output of breeding pairs may also contribute to a reduction in the long-term viability of California gnatcatcher populations adjacent to development.

2.2 CURRENT STATE AND FEDERAL STATUS OF THE CALIFORNIA GNATCATCHER

To date, the California gnatcatcher is not listed by federal or state resource agencies. It is presently a federal Candidate 2 species and a state Species of Special Concern. On September 18, 1990, the San Diego Biodiversity Project and Palomar Audubon Society filed a petition with the Portland Regional Office of the USFWS to list the California gnatcatcher as endangered under the federal Endangered Species Act of 1973. On December 15, 1990, the Natural Resources Defense Council (NRDC) and the Manomet Bird Observatory filed a separate petition with the USFWS to list the California gnatcatcher as an endangered species. This petition sought a listing on an emergency basis, or in the alternative, to list through the normal process under the Act. On September 5, 1991, the USFWS made the finding that listing of the California gnatcatcher is warranted and initiated preparation of a draft listing regulation to be circulated for public review. A final determination of whether to list the gnatcatcher will be made before March 17, 1993 by the USFWS. An emergency listing can be implemented by the USFWS at any time during this review process.

The NRDC petition was also filed with the CDFG on February 28, 1991. The Fish and Game Commission denied State Candidate Species status for the gnatcatcher on August 30, 1991. The NRDC has subsequently filed suit against the Fish and Game Commission to reverse their decision. A State Candidate Species is protected under the "taking" provisions of the State Endangered Species Act during the one-year public review process. Any proposed taking of a State Candidate Species during this time period must be done after a permit is granted by the CDFG.

2.3 California Gnatcatcher Biology

The gnatcatcher genus *Polioptila* is a distinctive group of small (5-7 grams), long-tailed, insectivorous songbirds. The genus consists of 12 species, primarily distributed throughout the tropical and sub-tropical New World. Three species occur in the United States. The plumage characteristics of *Polioptila* are relatively constant, being predominantly gray with varying amounts of black on the head of the adult male during the breeding season and varying amounts of white on the outer tail feathers. Based on a recent taxonomic study (Atwood 1988), the American Ornithologists' Union recognized the coastally distributed California gnatcatcher (*P. californica*) to be a taxonomically distinct species that is reproductively isolated from the black-tailed gnatcatcher (*P. melanura*) of the North American desert regions (AOU 1989). The California gnatcatcher historically was distributed from southern Ventura County eastward to western San Bernardino and Riverside counties and southward to the Cape region of Baja California.

There are three described subspecies of California gnatcatcher (Atwood 1991). *P. c. californica* is the only subspecies found in the United States, with its southern distributional limits at 30° N latitude. This latitude coincides with the southern distributional limits of the CSS plant community in which *P. c. californica* is typically found. *P. c. margaritae* occurs in Baja California from 30° N south to 24° N latitude and *P. c. abbreviata* occurs in the Cape region of Baja California, south of 24° N latitude.

The California gnatcatcher is a year-round resident of sage scrub habitats on the coastal slope of southern California and northwestern Baja California. Individuals are rarely seen outside areas of regular residency. The most striking plumage characteristic of *P. californica* is the fairly dark sooty-gray color of the underparts (Dunn and Garrett 1987). The underparts of the other two U.S. gnatcatcher species, the black-tailed gnatcatcher and the blue-gray gnatcatcher (*P. caerulea*), are much lighter in color. The blue-gray gnatcatcher is a "white-tailed" gnatcatcher due to its almost completely white outer tail feathers. The different color of the outer tail feathers is the diagnostic field character that distinguishes the California gnatcatcher from the blue-gray gnatcatcher during the winter months when these two species co-occur in the same area. The distributions of black-tailed and California gnatcatchers are geographically distinct within the U.S., but they co-occur in a small area of Baja California.

In addition to differences in plumage characters, the three U.S. gnatcatcher species also have distinct vocalizations. The blue-gray gnatcatcher's call is a soft *speeee*, which is unlike either of the two "black-tailed" species. The song of the black-tailed gnatcatcher includes a distinctive quick series of staccato *chee-chee-chee* notes on one pitch along with a descending, raspy wren-like call. The California gnatcatcher produces a variety of calls, but the most common call is a cat-like mew *zeeer*.

The California gnatcatcher resides in CSS habitats that typically are dominated by California sagebrush (*Artemisia californica*) and flat-top buckwheat (*Eriogonum fasciculatum*). In San Diego County, California gnatcatchers show a strong positive association for California sagebrush, flat-top buckwheat, broom baccharis (*Baccharis sarothroides*), and laurel sumac (*Malosma laurina*; RECON 1987, ERCE 1991, Mock et al. 1990). California sagebrush and flat-top buckwheat are the dominant plant species used by gnatcatchers when foraging for insects. Laurel sumac is used primarily as a high perch for territorial vocalization (ERCE 1991, Ogden 1992, unpublished data).

A strong negative preference has been documented for sage scrub dominated by black sage during drought conditions (*Salvia mellifera*; Mock et al. 1990, Atwood 1990, Bontrager 1991). Several black sage-dominated areas not occupied by gnatcatchers during drought years (i.e., 1988-1990) have become occupied during 1991 and 1992 (Ogden unpublished data, B. Jones pers. comm.). Under stressful environmental conditions, black sage may produce secondary plant compounds (e.g., terpenes; Tyson et al. 1974) that have insecticidal properties. The production of these compounds may make black sage less suitable for foraging gnatcatchers . Where black sage patches occur within a mosaic with patches dominated by California sagebrush, gnatcatchers show a preference for the sagebrush areas (Mock 1992).

A wide variety of sage scrub plant species are used for nesting by gnatcatchers. The choice of a host plant appears to be dependent on the relative availability of the plant species and its structural capability to support a nest (Atwood 1990; Ogden 1992, unpublished data). The nest typically is constructed of grasses, bark, small leaves, and other materials. Nests are usually placed less than 1 m from the ground in a shrub located on a flat to gentle slope (less than 40% slope; Ogden 1992). Vegetation structure around the nest site is typically composed of shrubs about 1 meter in height with a semi-open canopy. Gnatcatchers begin nest-building in late February and the first set of eggs is laid after March 20 (Unitt 1984). Nests at the incubation stage can be found in early August. Most nestlings leave the nest between early May and early July. Fledglings usually remain within their parents' breeding territory for 3-5 weeks. Nest predation is a common event, but breeding gnatcatchers are persistent, usually making several nesting attempts in a season.

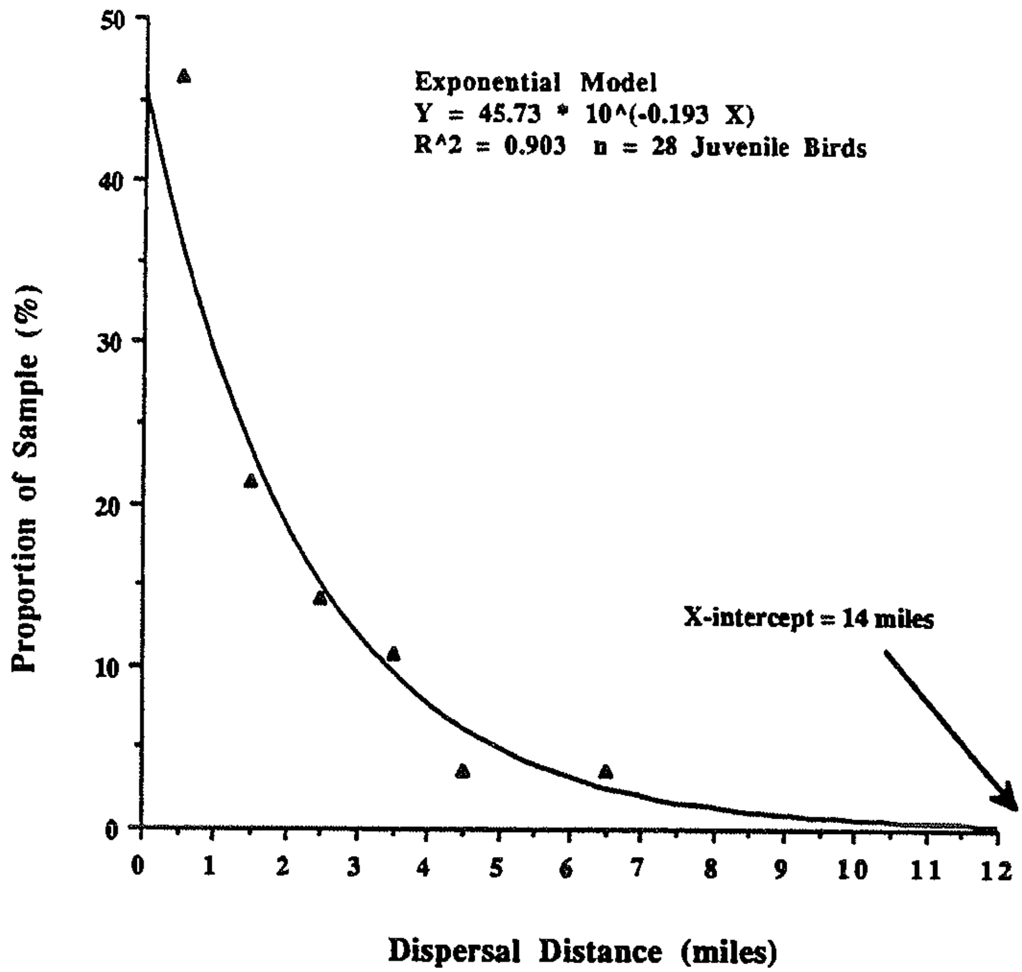
Producing more than one successful nest within a season is dependent upon seasonal climatic conditions, food availability, and predation pressure during the breeding season. The incidence of multiple brooding appears to be highly variable between years and location (Bontrager 1991, Braden 1992, ERCE 1991, Ogden 1992, Ogden unpublished data). Both sexes participate in territory defense, nest construction, incubation, and parental activities. Nest building requires 4 to 13 days prior to laying of the first egg of a clutch of 3 or 4 (rarely 5) eggs. The mean productivity of the gnatcatcher population in the Rancho San Diego area was 2.7 fledglings per pair for the three-year period of 1989-1991, with a coefficient of variation between years of 54% (ERCE 1991; Ogden 1992, unpublished data). Fledging success was lowest in 1990 (1.6 fledglings/pair) and highest in 1991 (4.3 fledglings/pair).

California gnatcatchers maintain year-round territories. The boundaries of the defended territory are usually sharply defined during the breeding season (late February to early August; Ogden 1992, Ogden unpublished data). During fall and winter, the home range of an established pair expands to include areas not used or defended during the breeding season. These winter expansion areas are not actively defended, but are neutral areas often used simultaneously by neighboring pairs. Breeding territory boundaries are defended throughout the year, although the intensity of aggressive behavior fluctuates seasonally. The most intense periods of territorial behavior is during the beginning of the breeding season and during the late summer and early fall when dispersing juveniles pass through established territories. Territory boundaries usually follow natural physical features such as ridges, roadways/trails, or where there is an abrupt change in vegetation composition (e.g., sage scrub-chaparral interface).

The California gnatcatcher appears to have highly variable and relatively large home range requirements for a small songbird. In San Diego County, documented gnatcatcher breeding home ranges have varied from 6 to 45 acres (SEB 1986, RECON 1987, ERCE 1991, Ogden 1992, Ogden unpublished data). The winter home range of a gnatcatcher pair is typically about 70% larger than their breeding season territory and, to a limited extent, occasionally includes habitats other than sage scrub (e.g., riparian scrub, chaparral; ERCE 1991, Atwood 1990; Ogden 1992, unpublished data). Ogden (1992) compiled home range size estimates for over 50 breeding territories. The overall mean is about 17 acres. Territories less than 7 miles from the coast, all of which are constrained by development, averaged slightly less than 10 acres and more inland territories averaged slightly less than 19 acres. Inland territories constrained by development averaged less than 11 acres. These data suggest that gnatcatchers may need 6 to 15 acres to meet their energetic requirements for breeding, but they are able to defend much larger areas, at least when population densities are relatively low. Gnatcatchers have enlarged their territories to encompass much of a neighboring territory when the neighboring pair died and was not replaced by dispersing juveniles (Ogden 1992).

Adult gnatcatchers appear to be site tenacious, remaining in the same territory for their entire adult life. The exception to this generality is when an experienced adult loses its mate between breeding seasons and is unable to acquire a new mate prior to the next breeding season. Ogden (1992, unpublished data) has documented several instances in which a widowed female abandoned her established territory and paired with a widower male in an adjacent territory. There has been one observation of an established male abandoning his territory. This was a male in a peripheral territory who lost his mate and was unable to acquire a new mate prior to the next breeding season. The majority of movements by established adults were less than 0.5 mile, with a maximum distance less than 2 miles ($n < 10$ birds).

To date, Ogden (1992) has documented the dispersal of 28 juvenile gnatcatchers banded in their natal territories. Assuming gnatcatchers prefer to follow corridors of natural topography and natural habitats relative to landscaped or graded areas, these juveniles dispersed from 0.5 to 6.1 miles from their banding site (Figure 1). Mean dispersal distance was 1.75 miles (± 0.26 SE), with a median of 1.37 miles. The maximum dispersal distance of juvenile gnatcatchers is likely to be larger than the maximum distance documented by Ogden's studies. Dispersal studies are limited by the size of the search area and the level of effort expended to detect banded individuals within the search area (Cunningham 1986). Average dispersal distance was nearly identical between sexes. In Riverside County, one banded juvenile gnatcatcher was resighted nearly 9 miles from the natal territory. The two other juveniles were both resighted 6.3 miles from their natal



OGDEN

Juvenile California Gnatcatcher Dispersal Capability

FIGURE 1

territories (Braden 1992). The Rancho San Diego data predict a maximal dispersal distance of about 14 miles using an exponential model (Figure 1).

Juveniles become independent of their parents 3-5 weeks after leaving the nest. Parents actively exclude independent fledglings from their territory by scolding and chasing them outside of their territory boundaries. Juveniles roam widely, sometimes briefly joining a neighboring family group until they are forced out by the established pair. Eventually juveniles find undefended areas between or at the edge of occupied territories to maintain themselves. Juveniles may mate with other first-year birds, or with established residents that have lost their mate. Pairing may occur within a few weeks after leaving the natal territory if a potential mate is encountered early, or the juveniles continue their dispersal further away. Most juveniles are established territorial residents by early October. A majority of juveniles likely die before they are able to acquire a mate and establish a territory (e.g., Sullivan 1989).

Information on annual adult survival is limited to Ogden's population studies in the Rancho San Diego area (Ogden 1992, unpublished data) and a one-year study conducted in southern Orange County (Bontrager 1991). Average annual adult survival in the Rancho San Diego area was 39.2% for the three-year period of 1989-1992 (Ogden 1992, unpublished data). Survival was low during cold, wet winters of 1989-1990 and 1991-1992, resulting in adult survival of 25.6% and 32.6%, respectively. The gnatcatcher population survived better during the milder 1990-1991 winter, with 59.5% of the adults surviving to breed in 1991. The 1990-1991 gnatcatcher study in Orange County had an annual adult survival of 60.9% (D. Bontrager pers. comm.). This range of variation in annual adult survival is consistent with that of other songbirds (Karr et al. 1990, Martin and Li 1992).

3.0 POPULATION VIABILITY ANALYSIS

3.1 Threats to the Viability of the Gnatcatcher Population

a. Direct Human Impacts

In general, the greatest threats to wildlife populations come as a direct consequence of human activities that cause habitat loss, degradation, and fragmentation. The first two directly reduce population size while the impact of fragmentation may be more subtle

(Wilcox and Murphy 1985, Rolstad 1991, Sanders et al. 1991). The fragmenting of habitat has been shown to lead to increased mortality in animal populations through a number of mechanisms. The interface between different types of natural habitats (i.e., ecotone) can be beneficial to some species. For instance, least Bell's vireos often nest at the interface between riparian and upland habitats. However, the interface between natural habitat and human-modified habitat (i.e., edge) is often associated with negative impacts that are generally detrimental to the value of the habitat to wildlife (e.g., Bolger et al. 1991, Harris 1988, Laurence and Yensen 1991).

The physical conditions along the edge of a patch of vegetation are different from those in the center. For this and other reasons, the composition of the vegetation is usually different at the edge than at the core of the patch (e.g., Alberts et al. *in press*). Human impacts also penetrate across the edge. Trampling of vegetation and path creation is usually greater near the edge of a patch. Alien plants and animals invade the native habitat at edges. Introduced predators, such as cats and dogs, and enhanced predators (natural predators whose densities are enhanced by the presence of humans), including skunks, raccoons and opossums, penetrate the native vegetation along edges (Churcher and Lawton 1987, Soulé et al. 1988). Because more of the area of a small patch is close to an edge than the area of a large patch, the usefulness of small patches as wildlife habitat is reduced. Excessive road traffic noise may also indirectly impact breeding gnatcatchers, but the available data are conflicting on this issue (Ogden 1992, RECON 1992). Brown-headed cowbird nest parasitism of gnatcatchers has been reported as being a potentially significant factor (Bontrager 1991, Braden 1992) to highly incidental (Ogden 1992, unpublished data). Direct and indirect impacts associated with development can be controlled through proper preserve design, habitat preservation, buffer zones, and appropriate habitat management (Kelly and Rotenberry *in press*).

b. Demographic Variability

Demographic variability is simply chance events that independently affect the survival and reproduction of individuals within a population. These are most important in very small populations. For instance, in a very small population (e.g., ten individuals), it is possible all individuals would die in a single year, independent of any climatic effects; or, all offspring born during a given period would be the same sex and if all the adults died, the population would be doomed because it would consist solely of the same sex. These types of demographic anomalies are a serious threat to only very small populations (e.g., < 20 individuals; Soulé 1983, Pimm et al. 1988, Tracy and George 1992).

c. Environmental Variability

Environmental variability is simply the natural vagaries of climate. Year to year variation in temperature, precipitation, and food supply affect the survival and reproduction of organisms. The viability of most populations decreases with greater environmental variation. A long series of bad years (i.e., years in which survival and/or birth rate are low) may threaten the existence of a population. In the absence of human-caused threats, environmental variation is probably the greatest threat to population viability (Dennis et al. 1991, Stacey and Taper 1992, Virkkala 1991). Annual fluctuations in birth rate and survival are the expression of environmental variability. Long-term population data, which would allow us to directly estimate year to year variation in survival, fecundity, and population density, do not exist for the gnatcatcher. Instead, we have considered the information that is available in the literature on annual variation of songbird population dynamics.

The traditional view is that annual variation in reproductive rate in arid region songbirds is driven by variation in precipitation. It has been amply demonstrated that primary productivity in arid zone vegetation is tightly correlated with precipitation. The density of plant-feeding insects upon which insectivorous birds feed also varies with precipitation. Thus, the level of precipitation determines the amount of food resources available to the birds. This should affect not only birth rate, but survival as well when precipitation coincides with cold temperatures (Gessaman and Worthen 1982, Lustick and Adams 1977, Ogden 1992, Ogden unpublished data). Empirical work has shown a linkage between variation in weather, food resources, and songbird demographic parameters (e.g, Holmes et al. 1991, Marr and Raitt 1983, Martin 1987, Rodenhouse and Holmes 1992, Simons and Martin 1992, Ogden 1992, Ogden unpublished data).

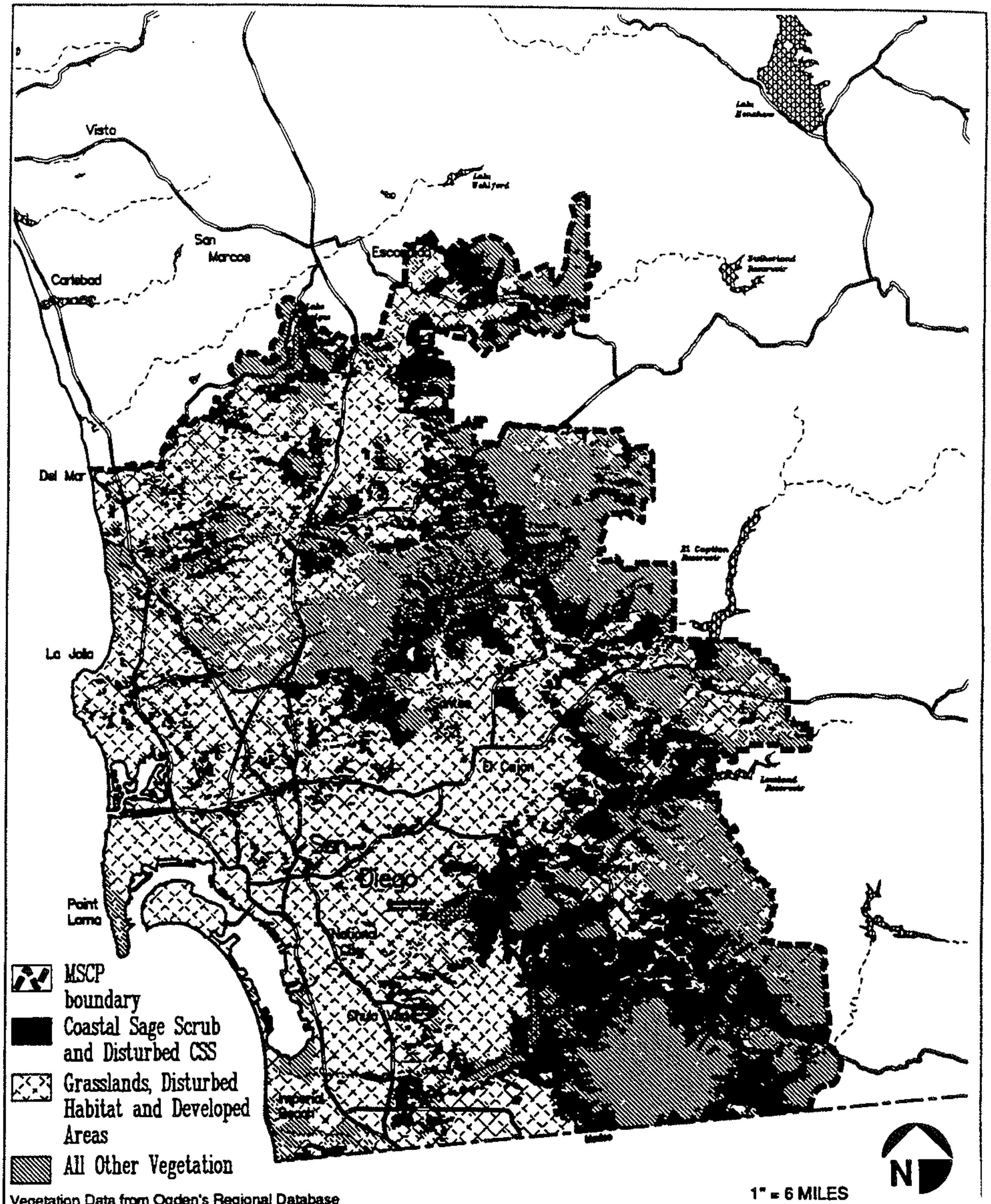
Other studies have shown a complex interaction of weather, nest predator density, and avian reproductive success. Rotenberry and Wiens (1989) found weak and often insignificant correlations between precipitation and reproductive parameters in three species of arid zone birds. They found nest predation rates to be the most important factor determining the number of offspring successfully fledged. The density of nest predators, primarily snakes and ground squirrels, did not respond directly to annual precipitation, but rather the response was lagged in time. Nest predation has been shown to be important in a number of songbird species. Nest failure due to predation is common in the gnatcatcher population, accounting for nearly 80% of unsuccessful nests with the predation event most often occurring during the egg stage (Bontrager 1991, Braden 1992, ERCE 1991, Ogden 1992, unpublished data). It is likely that gnatcatcher densities do respond to variation in weather; however, the relationship is likely to be a complex interaction with variation in predation pressure (Lima 1987, Martin 1992, Reitsma et al. 1990, Rotenberry and Wiens 1989, Ogden 1992, unpublished data).

3.2 Spatial Arrangement of Coastal Sage Scrub and California Gnatcatcher Populations in the MSCP Study Area

The vegetation communities within the MSCP study area were mapped by Ogden using color infrared aerial photographs (1:24,000), verified by helicopter overflights, existing detailed vegetation maps, and limited ground-truthing. The vegetation map was incorporated into a geographic information system (GIS) with Spot and Thematic Mapper satellite images for geographical reference. The CSS within the MSCP study area is located in a roughly north-south band that can be considered approximately continuous within a landscape mosaic (Figure 2). The somewhat patchy distribution of coastal sage scrub within the landscape has been further fragmented by intervening agriculture and urban development (O'Leary 1990).

Substantial populations of gnatcatchers (greater than 20 pairs) are located throughout much of this band of sage scrub (Figure 3). Significant areas of sage scrub, particularly in the more inland portions of the study area, have not been adequately surveyed. Hence, the known gnatcatcher distribution is biased toward coastal areas which are more likely to have had biological surveys conducted as part of the environmental review of proposed development. However, inland areas that have had focused gnatcatcher surveys generally support substantially lower gnatcatcher densities than coastal areas (Mock et al. 1990, Mock 1992, Ogden 1992, Ogden unpublished data).

The fragmented distribution of the CSS and the known concentrations of gnatcatchers suggest a metapopulation model is an appropriate representation of the California

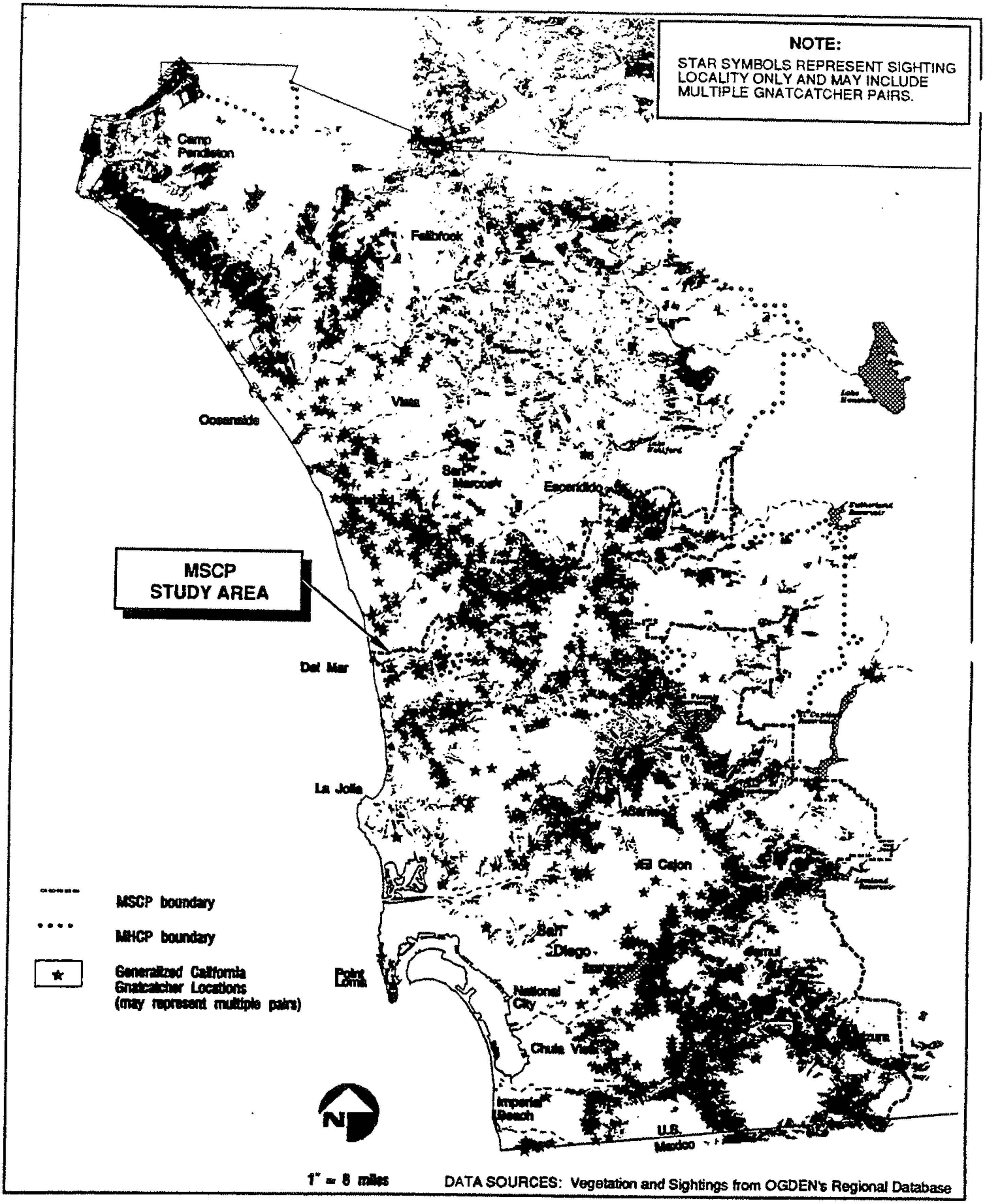


OGDEN

Distribution of Coastal Sage Scrub in the MSCP Study Area

FIGURE

2



OGDEN

California Gnatcatcher Sightings (1985 - 1992) in Western San Diego

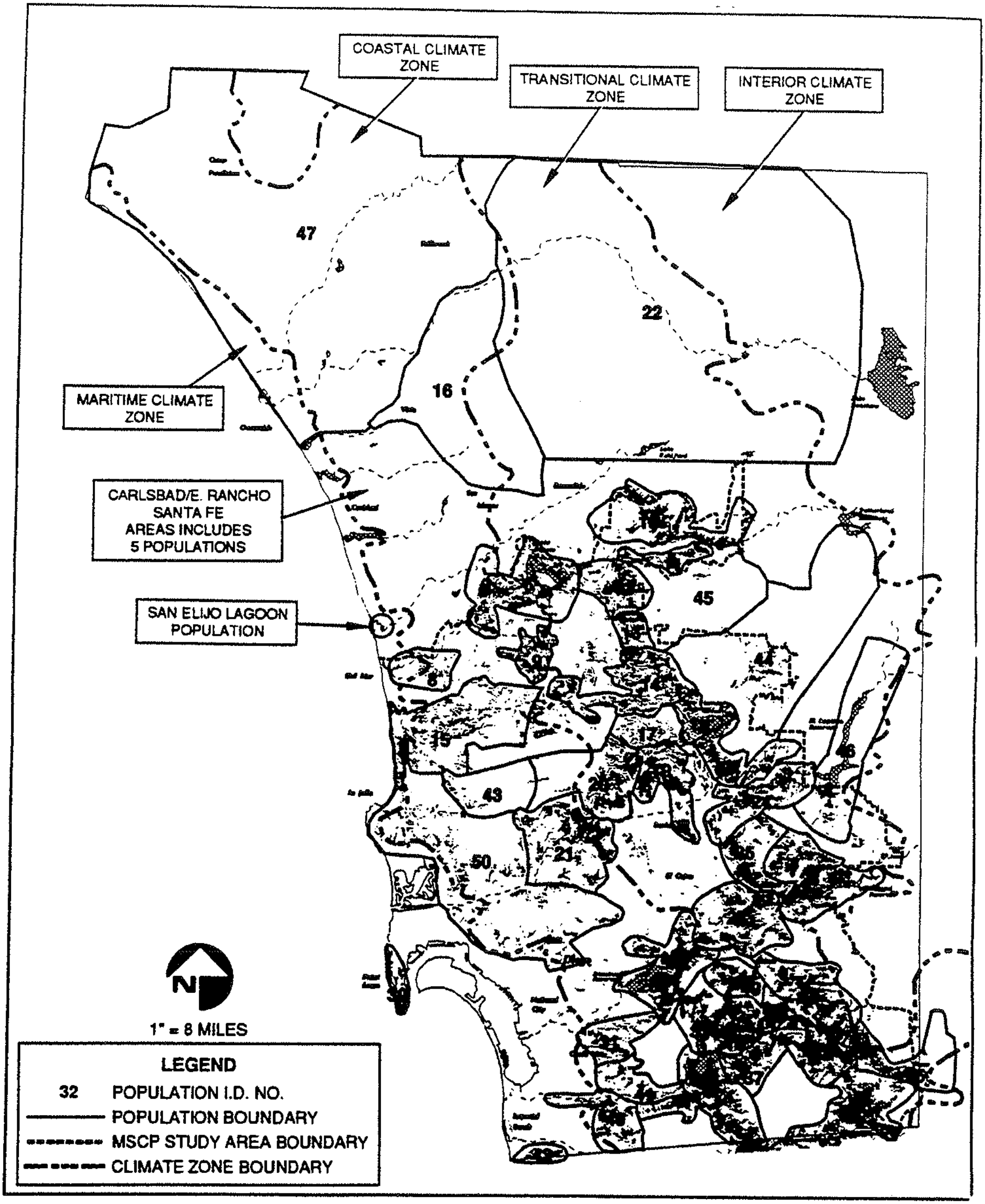
FIGURE 3

gnatcatcher population within the MSCP study area (Figure 4). Large areas of CSS and higher concentrations of gnatcatchers form the populations of the metapopulation. Smaller patches and linear strips of CSS and other intervening shrubland habitats serve as corridors between the populations. The eventual development of much of the land outside of the implemented reserve system will further accentuate the metapopulation characteristics of the gnatcatcher population in the study area.

The spatial arrangement of populations is very important to the dynamics of a metapopulation relative to a simple isolated population. Due to the distribution of CSS within the study area, the spatial arrangement of gnatcatcher populations is approximately linear from the Otay Mesa area to the Carlsbad area. The most direct connection to Camp Pendleton is assumed to be via the San Luis Rey River drainage system to Escondido since the developed portions of Oceanside and Vista most likely act as a barrier to gnatcatcher dispersal. Important east-west connections occur primarily along major drainages. For example, several populations (Del Mar, Lake Hodges, South Escondido/San Pasqual Valley) occur along the San Dieguito River, which likely functions as a dispersal corridor between these populations. Figure 4 depicts the segregation of potential gnatcatcher habitat into populations within the MSCP study area and the remainder of western San Diego County. This configuration was used in the metapopulation simulation model described below.

For the gnatcatcher simulation model, we assumed that the gnatcatcher metapopulation functioned at the landscape level as a network of populations with source-sink dynamics (Pulliam 1988, Pulliam and Danielson 1991, Dunning et al. 1992). Landscape refers to the mosaic of habitat patches in which a particular patch (or population) is embedded. The landscape level occupies the range of spatial scales between an organism's normal home range (<100 acres for the gnatcatcher) and its regional distribution (the four counties that currently support gnatcatchers in the United States). Source-sink dynamics is the process of differential exchange of migrants between populations due to differences in productivity between source (highly productive) and sink (less productive) populations. Sink populations eventually go extinct without immigration from a source population (i.e., the rescue effect; Brown and Kodric-Brown 1977, Stacey and Taper 1992).

Source and sink gnatcatcher populations were defined by climate zones, as delineated by the University of California Agricultural Extension Service (1970), in which each population resided (Figure 4). We assumed populations in areas with relatively mild



OGDEN

Segregation of California Gnatcatcher Habitat Into Populations For Input Into the Metapopulation Simulation Model

FIGURE 4

weather patterns (maritime climate zone) are more stable, resilient, and productive than areas with more variable and cooler weather patterns (transitional climate zone). Populations within the coastal climate zone were assumed to have intermediate population parameters in the continuum of source-sink dynamics.

3.3 GIS Habitat Evaluation for California Gnatcatchers within the MSCP Study Area

We evaluated the potential for coastal sage scrub within the MSCP study area to support California gnatcatchers by relying on three factors: CSS patch size, elevation, and slope gradient. Details of this evaluation model are provided in Appendix A. Table 1 presents the results of this three-factor model that delineates potential gnatcatcher habitat. Over 70% of the gnatcatcher sighting localities within coastal sage scrub (as mapped by the MSCP GIS database) occur in areas that met all three factors. CSS that met all three factors was considered to have the highest potential to support California gnatcatchers and was placed in either the Very High or High Value category in the MSCP Composite Habitat Evaluation Model (Appendix A).

3.4 Metapopulation Simulation Model - RAMAS/space

We used an existing metapopulation simulation program, RAMAS/space (Exeter Software, Setauket, New York) to explore the effects of spatial arrangement of populations in potential reserve designs. Lamberson (1992) recently reviewed the three versions of RAMAS available. RAMAS/space has recently been used to model populations of several vertebrates, including California spotted owl, light-footed clapper rail, seabirds, and amphibians (R. Akçakaya pers. comm.). RAMAS/space models metapopulations consisting of multiple, discrete populations such as our representation of the gnatcatcher metapopulation in Figure 4. The areas between the populations function only as movement corridors between populations.

RAMAS/space includes within-population dynamics (birth and death) and between-population dynamics (immigration and emigration). These population dynamics are modeled as randomization (stochastic) functions so that within-population growth is based on randomly drawn values from a predetermined lognormal probability distribution of the

TABLE 1

RESULTS OF CALIFORNIA GNATCATCHER GIS HABITAT EVALUATION MODEL FOR THE MSCP STUDY AREA

Category	CSS Habitat (acres)	Total No. Gnatcatchers in CSS within Category†	Percent of Gnatcatchers in CSS within Category†	Percent of All Gnatcatchers within Category†
All CSS within MSCP Study Area	117,602	1,429	100%	84%
BASIC FACTORS				
Large CSS Habitat Patches*	97,070	1,225	86%	72%
CSS Below 950-foot Elevation	72,689	1,280	90%	76%
CSS on Slopes less than 40%	95,793	1,313	92%	78%
COMBINATION OF BASIC FACTORS				
Large Patch Size & Elevation	57,664	1,095	77%	65%
Large Patch Size & Slope	77,576	1,124	79%	66%
Elevation & Slope	63,691	1,193	83%	70%
All Three Factors	49,643	1,015	71%	60%

† Total number of gnatcatcher localities in MSCP GIS database is 1694; a minority of sightings (265) occur in baccharis scrub and other types of scrub that were classified as habitats other than CSS.

* CSS Patches ≥ 25 acres in maritime and coastal climate zones and ≥ 50 acres in transitional climate zone.

average population growth rate (R). Demographic and environmental stochasticity, environmental correlation between populations, and density-dependent growth are other features included in the model. Between-population migration is a two-way, density- and distance- dependent process based on a user-specified migration function with stochastic sampling from a binomial distribution.

The following model parameters can be specified by the user for each population:

1. **Maximum Population Growth Rate (R_{max}).** A discrete-time, density-dependent logistic growth function was employed:

$$N_{t+1} = N_t \cdot \exp\left[r \cdot (K - N_t / K) \right],$$

where r is the instantaneous rate of increase at low population densities. r is defined as the natural logarithm of the finite rate of population increase (R): $r = \ln(R)$. R_{max} is the slope of the growth curve as the population size at time t (N_t) approaches zero. The input value of R_{max} is a value appropriate when the population size is low and well below the population carrying capacity (K). Population growth was assumed to be density independent at low population sizes (i.e., Allee effects were not included in our simulations; however, RAMAS/space does include an option for Allee effects).

2. **Standard Deviation of R.** This parameter makes the simulation stochastic and is used to model the fluctuations in the population growth rate (R). This parameter defines the lognormal statistical distribution of R for each population. We assumed a coefficient of variation (CV) of 30% or 40% of R_{max}, based on population parameters from long-term population studies of songbirds (Table 2).

3. **Carrying Capacity (K).** The logistic growth function includes a parameter for the carrying capacity of each population. An estimate of carrying capacity was made for each population dependent upon available habitat, climate zone (Figure 4), and conservative estimates of population density for each climate zone. For populations with documented gnatcatcher populations that exceeded the estimated K, the value of K was calculated as 1.2 times the known population size. The majority of the available population data was collected during years of relatively poor environmental conditions (e.g., drought, harsh winters); thus most of the population estimates are expected to be below carrying capacity. This is supported

TABLE 2

VARIATION IN ANNUAL SURVIVAL AND PRODUCTIVITY IN SMALL SONGBIRDS

Species	Location	Coefficient of Variation (%) Annual Adult Survival	Annual Productivity	Sample Size (years)	Source
Blue Tit	Belgium	12.6	7.9	10	Dhondt et al. 1990
	France	8.2		10	Blondel and Pradel 1990
	Corsica	7.9		10	Blondel and Pradel 1990
Great Tit	United Kingdom	41.8	8.5	17, 13	Colbert et al. 1988, Perrins and Moss 1975
	Netherlands	9.0		8	Drent 1984
	Finland		32.5	12	Orell 1983
Pied Flycatcher	Finland		38.0	22	Järvinen 1989
	Finland		43.9	7	Järvinen and Väisänen 1984
	England		11.7	17	Stenning et al. 1988
	Sweden	26.9		3	Alatalo et al. 1990
Willow Tit	Finland		30.9	7	Orell and Ojanen 1983
	Sweden		23.5	7	Ekman 1984
White-crowned Sparrow	San Francisco Co.		24.2	6	Petrinovich and Patterson 1983
Cassin's Finch	Washington	25.4		5	Mewaldt and King 1985
Mountain Chickadee	New Mexico	17.1	8.8	5	McCallum 1990
Rock Pipit	Sweden		14.9	6	Askenmo and Neergaard 1990
Yellow-eyed Junco	Arizona	32.8	51.2	5, 6	K. Sullivan pers. comm.
Sage Sparrow	Oregon		37.3	5	Rotenberry and Wiens 1989
Brewer's Sparrow	Oregon		23.2	5	Rotenberry and Wiens 1989
Sage Thrasher	Oregon		36.6	5	Rotenberry and Wiens 1989
Wrentit	Marin Co.	18.8	26.2	10	N. Nur pers. comm.
Song Sparrow	Marin Co.	17.5	47.1	10	N. Nur pers. comm.
Prairie Warbler	Indiana	33.1	26.6	8, 9	Nolan 1978
Least Bell's Vireo	Riverside Co.		32.3	7	L. Hayes pers. comm.
	Santa Barbara Co.		30.3	7	J. Greaves pers. comm.
Black-throated Blue Warbler	New Hampshire		20.5	5	Holmes et al. 1992
American Redstart	New Hampshire		33.4	9	Sherry and Holmes 1992
Cactus Wren	Arizona	42.7	26.5	4, 6	Anderson and Anderson 1973
European Dipper	England	20.1		5	Lebreton et al. 1992
Barn Swallow	Sweden		10.8	18	Møller 1989
Sand Martin	Sweden	25.0	30.0	20, 18	Persson 1987a, 1987b, Svensson 1986
	Hungary	26.2		4	Szép 1991
Collared Flycatcher	Hungary		19.9	4	Török and Tóth 1987
Pygmy Nuthatch	Arizona		8.1	4	Sydeman et al. 1988
California Gnatcatcher	San Diego Co.	46.9	53.9	3	Ogden 1992, unpubl. data
all studies	Mean ± SD (n)	24.2 ± 12.2 (17)	27.1 ± 13.1 (28)		
	Median	25.0	26.6		
studies ≥ 5 years	Mean ± SD (n)	20.7 ± 10.6 (13)	27.1 ± 12.1 (25)		
	Median	18.8	26.6		

by recent increases in local populations during 1991 and 1992. For example, the Rancho San Diego population increased 76%, from 17 pairs in 1991 to 30 pairs in 1992 (Ogden 1992). Substantial population increases have been reported elsewhere in San Diego County, as well as in Orange and Riverside counties (N. Gilbert, H. Wier, B. Jones, K. Merkel, R. Ericson, B. Wagner, pers. comms.), suggesting that a normal to above-normal rainy season followed by a relatively mild winter allows for substantial population increases when populations are well below carrying capacity.

4. **Initial Population Size.** This parameter was set at the number of gnatcatcher pairs documented within the population or at K/1.2, whichever was larger.

5. **Survivorship (S).** This parameter is the average annual adult survival rate and is used to incorporate demographic stochasticity into the model (Brillinger 1986, Akçakaya 1991). R, the population growth rate, can be expressed as: $R = S \cdot (1 + F)$, where F is fecundity (number of fledglings per pair per year). Given R (sampled from a lognormal distribution) and S, RAMAS/space first calculates F from the above equation. The number of adult survivors (A) is drawn from a binomial distribution with S as the probability and N_t as the sample size. The number of young produced (Y) is then drawn from a Poisson distribution with a mean of $A \cdot F$, resulting in the population size for the next year: $N_{t+1} = A + Y$. An annual survival estimate of 0.55, the typical annual adult survival rate for songbirds (Karr et al. 1990, Martin and Li 1992), was assigned to coastal populations (populations within maritime and coastal climate zones). A more conservative value of 0.40 (Ogden 1992) was assigned to populations residing in the transitional climate zone.

6. **Migration.** The migration function in RAMAS/space defines the proportion of individuals that successfully migrate between populations. A migration matrix is made by the model where each element of the matrix gives the proportion of one population migrating to another population. In the gnatcatcher metapopulation model, only migration between populations connected primarily by native vegetation, especially CSS, was allowed. No migration was allowed between populations with substantial intervening development (e.g., no migration between Point Loma, population 30, and West Otay Mesa, population 40; Figure 4).

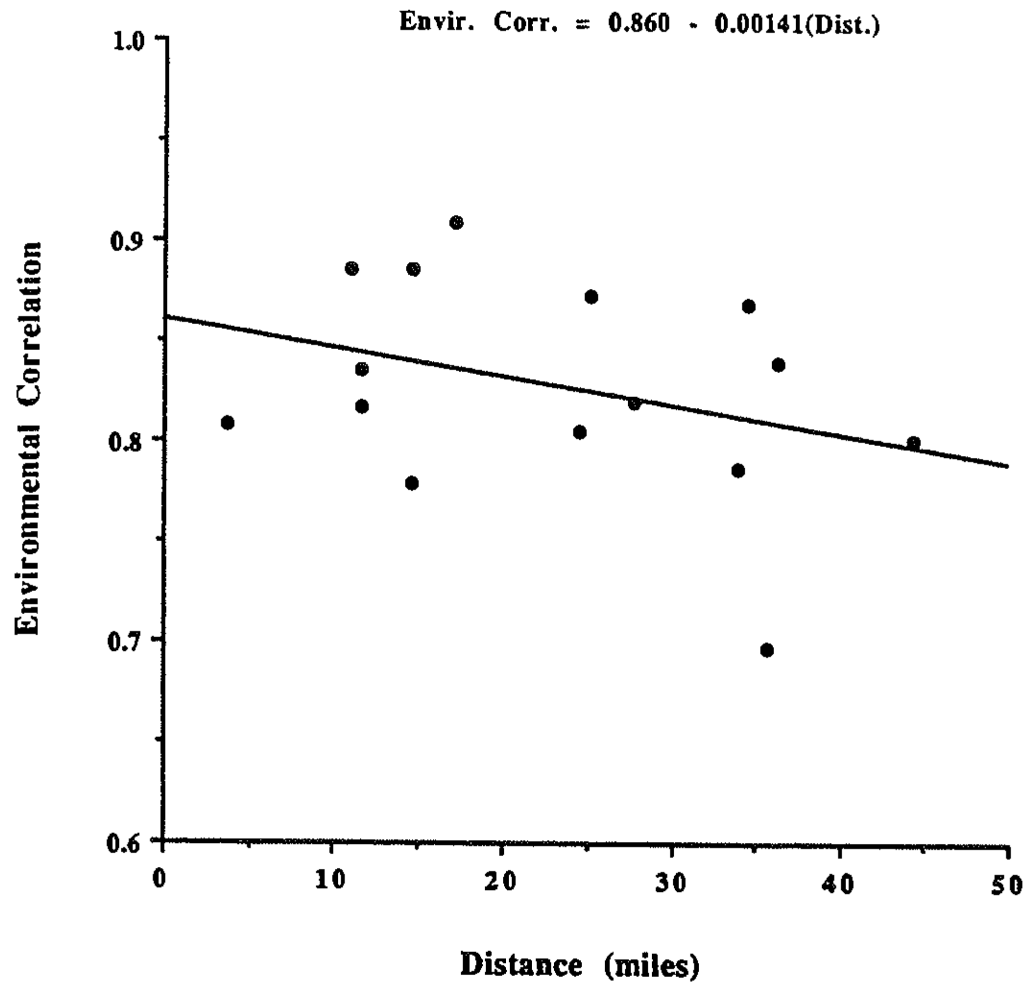
Migration proportions (M) can be input into the migration matrix as either a constant rate (e.g., 0, 0.1, 1.0, or 10 percent) or as a decreasing function of the distance between patches. The distance between populations was calculated from the center of each population habitat patch. The migration-distance function that approximates the relationship shown in Figure 1 is:

$$M_{ij} = 0.46 \exp\left[-d_{ij}/1.75\right],$$

where d_{ij} is the distance (miles) between populations i and j. The migration function contributes to demographic stochasticity by sampling the number of migrants at each time step from a binomial probability distribution.

RAMAS/space includes a density-dependent migration option that was included in our gnatcatcher model. This assumes that dispersing gnatcatchers are more likely to remain within their natal population if there is unoccupied habitat available. The relatively steep dispersal curve (Figure 1) supports this assumption. The rate of migration (and consequently the probability of recolonization of the population receiving immigrants) is an increasing function of population density of the source population. We assumed that a dispersing individual can only perceive the population density of the source population and not the density of the population to which it is dispersing. We chose the intermediate slope value of +0.5 for the relationship between migration rate and population size.

7. **Spatially-dependent Environmental Correlation.** Although R for any population can be modeled as a random variable between years, the R experienced by populations within the same year should be environmentally correlated relative to their spatial distribution. The environmental correlation between two patches should increase the closer the patches are to each other. We estimated this correlation-distance function by using correlations of climate (i.e., average monthly minimum temperature during winter) between six weather stations (Oceanside, San Diego, Chula Vista, Escondido, La Mesa, and El Cajon) within San Diego County (Figure 5). RAMAS/space allows a correlation matrix between populations to be specified, and the R value of each population at each time step is assigned with this correlational constraint. For our gnatcatcher model, environmental correlation between populations ranged from 0.78 to 0.86.



OGDEN

Effect of Distance on Environmental Correlation of Winter Monthly Minimum Temperature between Six Locations in San Diego County

FIGURE 5

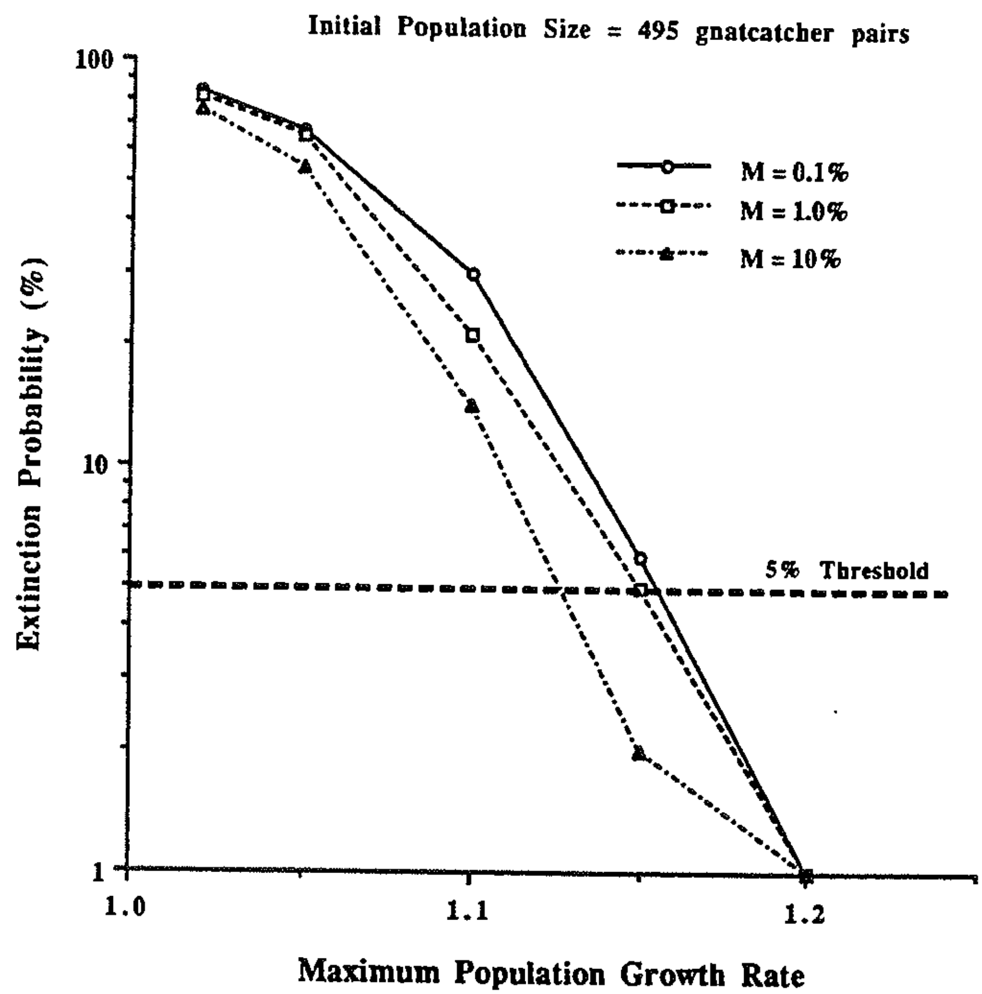
3.5 APPROPRIATE USES OF RAMAS/SPACE

RAMAS/space is a generalized model that is best used in a comparative fashion to explore the relative merits of alternative reserve designs. The uncertainty of the model's input parameter values (i.e., long-term population averages and variances) and the degree of approximation required to realistically represent gnatcatcher population dynamics make this relatively simple population model primarily a heuristic tool. Population modeling provides an objective method of estimating the relative viability of alternative reserve designs and can be used in a comparative manner to determine minimum reserve patch size, the relative importance of a given patch within a metapopulation network of habitat patches, or which potential addition to the reserve system would increase the viability of the network the most.

3.6 SENSITIVITY ANALYSIS OF RAMAS/SPACE

Preliminary simulations of the RAMAS/space model using a metapopulation of 495 pairs distributed into 13 populations indicate that the model is highly sensitive to variation in the value of R_{max}, the maximum population growth rate (Figure 6). Since R_{max} is defined as the population growth rate when the population size is well below the population carrying capacity (K), the value of R_{max} is greater than 1.0, the value of R of a population stabilized at K. Long-term population studies of small, short-lived bird species have recorded one-year population increases ranging from 1.18 to 2.66 (e.g., Hildén 1990, Dhondt et al. 1990, McCallum 1990, Dennis et al. 1991, Holmes et al. 1992, Sherry and Holmes 1992, Stacey and Taper 1992). Therefore, values of R_{max} greater than 1.1 appear to be reasonable for the gnatcatcher, which appears to have typical songbird life history traits. For scenarios with source-sink dynamics, sink populations within the transitional climate zone were modeled with a R_{max} of 1.05.

The model appears to be moderately sensitive to variation in M, the migration rate between populations (Figure 6). The migration-distance function described above produced a sensitivity curve similar to the curve with M = 1.0%. A relatively low level of exchange between immediately adjacent populations appears to be sufficient to effectively rescue a sink population that is close and adequately connected to a productive source population (e.g., Stacey and Taper 1992). Many gnatcatcher populations within San Diego County



OGDEN

Sensitivity of Metapopulation Simulation Model
to Maximum Population Growth Rate and
Migration Rate (M) Between Adjacent Populations

FIGURE 6

are currently interconnected by extensive widths of coastal sage scrub, much of which is known to be occupied by gnatcatchers (Figure 3).

The RAMAS/space model also appears to be highly sensitive to the variance of R. We initially assumed a coefficient of variation (CV) of R was a constant 30% of R_{max}. Two preliminary model simulations with 13 populations were performed where all parameters remained constant except for the CV of R, which was input as either 30% or 25% of R_{max}. The extinction probability for the metapopulation with a 30% standard deviation of R was 7 times larger (21% vs. 3%) than the simulation with a 25% standard deviation of R. For long-term studies ($\geq$ 5 years) of songbird populations, the median CV of annual adult survival is about 19%, while the median CV of productivity is approximately 27% (Table 2). This suggests an appropriate range for the CV of R_{max} is between 30 and 40%.

Based on this preliminary sensitivity analysis of RAMAS/space, a more extensive evaluation was conducted with respect to R_{max}, CV of R, and Survival (S) (Table 3). For this set of simulations, we used a metapopulation of 45 San Diego County populations (Figure 4) and the migration-distance function defined above. The initial county metapopulation size was estimated at 2,200 pairs (Appendix B). All populations were assigned the same set of population parameters. Table 3 demonstrates that RAMAS/space has high to moderate sensitivity to all three parameters evaluated. As would be expected for a species with life history traits of the gnatcatcher, simulations with R_{max} less than 1.10 resulted in high extinction probabilities regardless of CV of R and S. The outcome of simulations with R_{max} = 1.10 were dependent upon the values of CV of R and S, with CV of R being more sensitive than S. A relatively large metapopulation with R_{max} = 1.2 has a low extinction probability.

Long-term studies of songbird populations suggest that R_{max} typically exceeds 1.10, CV of R is approximately 30-40%, and S averages 0.55. However, most of these population studies were conducted at single locations and usually within optimal habitat for the species examined. We expect that a gnatcatcher metapopulation with source-sink dynamics would have sink populations within suboptimal habitat maintained by immigration from highly productive source populations. Therefore, population parameters of R_{max}, CV of R, and S are likely to vary across the landscape, as suggested by the variation in gnatcatcher population densities relative to the distance from the coast (Mock et al. 1990, Ogden 1992).

Table 3

SENSITIVITY ANALYSIS OF
R_{MAX}, COEFFICIENT OF VARIATION OF R, AND SURVIVAL
WITH A METAPOPULATION OF 2,200 GNATCATCHER PAIRS
DISTRIBUTED AMONG 45 SAN DIEGO POPULATIONS

Simulation ID	R_{max}	Coefficient of Variation	Survival	Extinction Probability (%)
Worst Case 1	1.05	40	0.40	71
Worst Case 2	1.05	30	0.40	32
Worst Case 3	1.05	30	0.55	26
Intermediate Case 1	1.10	40	0.40	38
Intermediate Case 2	1.10	40	0.55	20
Intermediate Case 3	1.10	30	0.40	3
Intermediate Case 4	1.20	30	0.55	1
Best Case 1	1.20	40	0.40	3
Best Case 2	1.20	40	0.55	1
Best Case 3	1.20	30	0.55	<<1

Simulations run with a 200-year horizon, 100 replications, active demographic stochasticity function, distance-dependent migration and environmental correlation. Initial population sizes and K estimates based on habitat acreage above/below 40% slope and edge effects (Appendix B).

4.0 RESULTS

4.1 VIABILITY OF THE CALIFORNIA GNATCATCHER METAPOPULATION IN SAN DIEGO COUNTY AND THE MSCP STUDY AREA

The current California gnatcatcher metapopulation within the MSCP study area likely exceeds 900 pairs based on the Ogden gnatcatcher database and the extent of potential CSS habitat. We simulated metapopulation scenarios based on our current perception of the existing San Diego County configuration (Figure 4) and various reserve designs formulated from the results of the MSCP Composite Habitat Evaluation Model (Figure 7; Appendices A-C). The results presented in Table 4 suggest that the current county-wide and MSCP metapopulations are probably viable, assuming $R_{max} \geq 1.1$ for productive source populations. The viability of the MSCP metapopulation is likely due to the existence of five major concentrations (Otay, Sweetwater, Mission Trails/Santee, Poway, and Lake Hodges) which act as source populations to the relatively smaller interconnecting populations (Figure 4). During periods of low population levels, these source populations

TABLE 4

SOURCE-SINK SCENARIOS OF CURRENT COUNTY AND MSCP METAPOPULATIONS AND SELECTED RESERVE DESIGNS

Simulation Scenario*	No. Populations	Initial Metapopulation Size (pairs)	Proportion (%) of Metapopulation in Transitional Climate Zone	Extinction Probability (%)	Probability of Reduced Metapopulation § (%)
Existing Condition, Entire San Diego County - One Metapopulation	47	2,373	42	3	58
Existing Condition SDC - Two functionally independent Metapopulations, Barrier @ I-8 Lakeside	47	2,373	42	2	33
Existing Condition, only MSCP Study Area	35	1917	45	<<1	5
Only MSCP core populations - all CSS conserved (see Appendix C)	21	1545	43	10.5	39
MSCP Composite Model - Only Very High Value CSS in core populations conserved	21	1230	38	11.5	43
MSCP Composite Model - all Very High Value CSS conserved in all MSCP populations	35	1419	40	13.5	46
MSCP Composite Model - all Very High Value CSS plus 3 north county coastal populations†	38	1701	31	<<1	3
MSCP Study Area - Reduce K of core populations by 30%, all other populations by 50%	35	1268	45	<<1	4

* see Appendices B and C for distribution of metapopulation

§ Probability of metapopulation being reduced to 20% of initial population size after 200 years.

† North County populations: Camp Pendleton (175 pairs), SE Carlsbad/E Rancho Santa Fe (100 pairs), San Elijo Lagoon (7 pairs).

ASSUMPTIONS AND INPUT PARAMETERS USED IN SOURCE-SINK SCENARIOS

1) Model set for 200 year horizon, 300 replicate simulations, density-dependent migration = 0.5, demographic stochasticity function active.
2) Percent Migration = 0.46 exp(-d/1.75); this approximates Ogden's exponential dispersal model.
3) Environmental Correlation = 0.86 exp(-d/500) ; r-values range from 0.86 to 0.78 for San Diego County which is consistent with correlations of weather data.
4) Initial population size assumed = K/1.2 unless known pop. size was greater, then K= 1.2 • known population size.
5) K estimate determined from conservative population densities assumed for each climate zone, habitat available above and below 40% slope, and amount of habitat influenced by development edge effects.
6) For Source-Sink model input parameters varied by climate zone (R, CV of R, S):
   Maritime = 1.2, 30%, 0.55; Maritime/Coastal = 1.2, 40%, 0.55; Coastal = 1.1, 30%, 0.55; Coastal/Transitional = 1.1, 40%, 0.55; Transitional = 1.05, 40%, 0.40.
7) For Very High CSS, K estimated by Climate Zone and habitat acreage:
   Maritime Very High CSS K = 20 ac/pr; Coastal Very High CSS K = 35 ac/pr; Transitional Very High CSS K = 50 ac/pr.

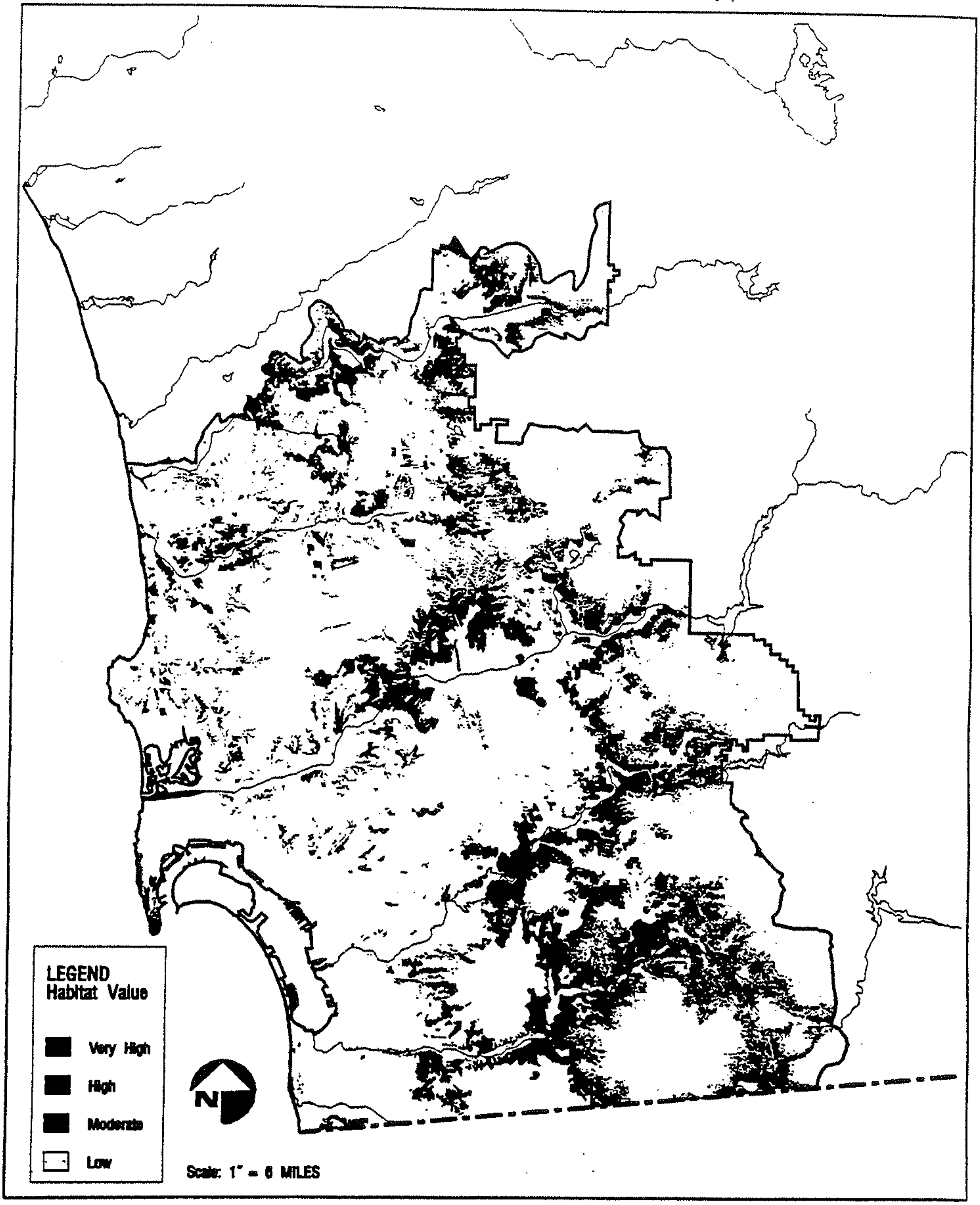


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FIGURE 7

MSCP Composite Habitat Evaluation of Coastal Sage Scrub likely rescue smaller or less productive habitat patches that may become temporarily unoccupied (Pulliman 1988, Gilpin 1990). Many of the smaller populations positioned between source populations likely act as steppingstone patches, enhancing inter-population connectivity and contributing to the size and viability of the metapopulation.

Various hypothetical reserve network configurations simulated produced varying results (Table 4). Conserving only CSS habitat (all CSS or only high value CSS) in the designated MSCP core populations results in extinction probabilities of 10-12%. These relatively high extinction probabilities are likely due to excessive distance between source and sink populations. Excessive distance between populations inhibits effective migration and probably prevents the rescue of sink populations that often go extinct. Conserving all high value CSS throughout the MSCP study area also resulted in a relatively high extinction probability of 13.5%. This may be due to an uneven distribution of the metapopulation between source and sink populations. The addition of three coastal north county source populations to the high value CSS model reduces the extinction probability to well below the designated 5% threshold criteria for population viability. Reducing K of MSCP core populations and the remainder of the MSCP populations by 30% and 50%, respectively, results in an extinction probability of less than 1%. The probability that the metapopulation may be reduced to 20% of the initial population after 200 years is high for many of the scenarios presented in Table 4. This is probably due to the gnatcatcher's high annual variation in reproductive and survival rates which leads to large fluctuations in population size/density.

4.2 Minimum Patch Size for Gnatcatcher Reserves

Individual reserves should be of sufficient size to minimize local population extinction due to isolation by an extreme environmental catastrophe (e.g., large-scale fire). Thus, each conserved population should be able to withstand short intervals (i.e., 50 years) of isolation from the remainder of the metapopulation network. The RAMAS/space model was configured for a single population with varying population sizes to assist in determining the minimum patch size for the proposed reserve design. The results of this series of simulations are presented in Table 5. Depending on the population size and value of R_{max}, we may expect an isolated population to have an extinction probability of 1 to 79 percent over a 50-year planning horizon. A realistic prediction of extinction probability is probably at the lower end of this range since the value of R_{max} is likely to be greater than 1.1 for populations not considered population sinks. A minimum patch size supporting more than 50 gnatcatcher pairs is probably sufficient for moderately productive populations. Minimum patch sizes for highly productive habitats may support as few as 20 gnatcatcher pairs as suggested by empirical studies of insular songbird populations (Soulé 1983, Pimm et al. 1988, Tracy and George 1992) and the continued existence of the isolated gnatcatcher population on the Palos Verdes peninsula in Los Angeles County (Atwood 1990). These recommended minimum patch sizes should be for "satellite" (steppingstone) reserves that are between larger "core" reserves. Satellite reserves function to enhance the connectivity between core reserves and substantially contribute to the overall viability of the metapopulation.

Table 5

SIMULATION OF SINGLE ISOLATED POPULATION OF VARYING SIZE FOR A 50-YEAR PLANNING HORIZON

Population Size (pairs)	R_{max}	Extinction Probability (%)
20	1.10	79
20	1.20	70
50	1.10	47
50	1.20	29
100	1.10	25
100	1.20	5
200	1.10	16
200	1.20	1

Simulations run with CV of R = 30%, S = 0.55, K = initial population size, 100 replications, and active demographic stochasticity function.

5.0 CONCLUSIONS

Population modeling can provide a heuristic method of estimating the viability of alternative reserve designs. Such models can be used in a comparative manner to determine minimum patch size, the relative importance of a given patch within a metapopulation network of habitat patches, or which potential addition to the reserve system would increase the viability of the network the most. We have used this model to compare the adequacy of several preliminary alternative reserve designs. A primary lesson of this analysis is the importance of retaining linkages between the populations. It is clear that retaining the interconnections of the metapopulation is critical to the viability of each gnatcatcher population. Without functioning corridors to link the populations, the metapopulation viability will likely be low.

Metapopulation simulation models have shown that the dynamics of simulated metapopulations are driven to a large extent by the larger populations. Smaller, more peripheral populations usually can be lost without greatly affecting the viability of the entire system, but the loss or serious reduction of one or more of the larger populations has a great effect on the overall viability of the model system (Gilpin 1990). The largest gnatcatcher populations will likely be most critical to the overall viability of the metapopulation. The expectation that a given population is critical to the metapopulation can be tested by simulating the gnatcatcher metapopulation to estimate the viability of the metapopulation with one or more populations removed or reduced in size.

The gnatcatcher reserve system must sufficiently span the length and width of the MSCP study area to facilitate demographic and genetic exchange within and outside of the study area and minimize the adverse effects of environmental correlation between adjacent populations. The relative distribution of source and sink populations within the metapopulation will also influence metapopulation viability. Conserved habitat should be prioritized toward retaining as many of the larger source populations as is feasible. Due to the current distribution of sage scrub and gnatcatchers, the reserve system must consist of several reserves primarily aligned along a north-south axis. Our initial reserve design (based on our current knowledge) is a system of at least twelve (12) "core" reserves of relatively large blocks of gnatcatcher-occupied coastal sage scrub. These core reserves are (see Figure 4, Appendix C): Lake Hodges area (population 6), Black Mountain (population 9), Escondido/San Pasqual Valley (populations 10 and 11), North Poway (populations 12 and 13), South Poway (including Van Damm Peak; population 14), Los Peñasquitos Canyon (population 15), Mission Trails/Camp Elliot/Santee (including Rattlesnake Mountain; populations 19, 20, and 21), South San Vicente/Lake Jennings (populations 23 and 24), Dehesa/Upper Sweetwater River (including McGinty Mountain; populations 24 and 25), Lower Sweetwater River/San Miguel Mountains (including Dictionary Hill; population 28), Jamul Mountains (population 32), San Ysidro Mountains/Otay River/Otay Mesa (populations 37, 39, 40, and 41). These core reserves will need to be supplemented with a sufficient number of smaller "satellite" (steppingstone) reserves in between to enhance connectivity between core reserves and achieve a minimum viable metapopulation size.

This population viability analysis used estimates of model input parameters that were on the conservative side of the range of biologically realistic values. For example, we used 1.2 as the largest value of R_{max} in our simulations, a value that is at the low end of the range of estimates reported in long-term songbird population studies. Gnatcatcher populations appeared to increase 75% or more in many areas between 1991 and 1992. Our sensitivity analysis of RAMAS/space showed that R_{max} is the most sensitive parameter influencing extinction probability. Therefore, the simulations presented in this analysis likely overestimate the extinction probabilities for the various metapopulations configured.

We also assumed that all of the existing coastal sage scrub habitat potentially supported gnatcatchers. Less than half of the the CSS habitat within the study area has been adequately surveyed. We likely overestimated the size of many of the potential populations in the transitional climate zone and possibly underestimated the size of some populations within the coastal or maritime climate zones. Population size and carrying capacity also significantly influence the outcome of the RAMAS/space model, as demonstrated in our simulations of an isolated population. We assumed carrying capacity was 20% larger than the initial population size. Potential effects of cowbird nest parasitism were not incorporated into this analysis due to the lack of information on the relative extent of this potential problem within and between populations. Certain populations may be significantly affected by cowbird parasitism (e.g., Bontrager 1991, Braden 1992), hence, model input parameters for parasitized populations would be substantially different (e.g., lower R and higher CV of R) from populations without this problem.

Adequate surveys of all potential gnatcatcher habitat within the study area and population studies of several gnatcatcher populations in geographically distinct locations (i.e., representative populations in different climate zones) are needed to refine this population viability analysis. These studies should gather information on variation in population size/density, reproductive success, annual survival, juvenile recruitment, and dispersal capability, particularly in response to adjacent development and variation in predation/parasitism and weather. Within-year comparisons of these populations would verify our assumptions of source-sink population dynamics and distance-dependent environmental correlation between populations.

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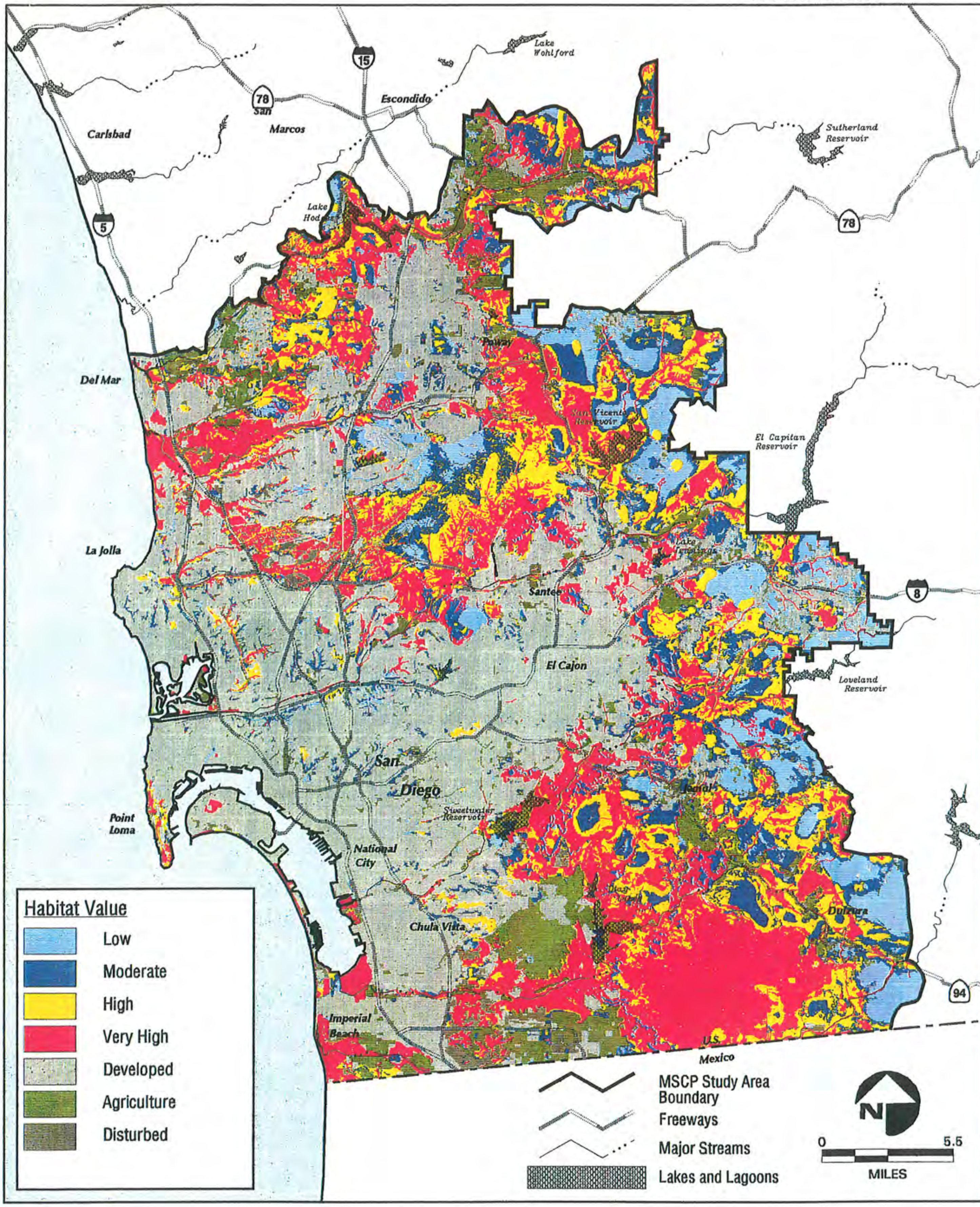

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Habitat Evaluation Map

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ATTACHMENT K

LIST OF SAN DIEGO COUNTY VEGETATION COMMUNITIES AND THEIR TIER LEVELS WITHIN THE MSCP*

TIER I

Closed Cone Coniferous Forest including Torrey Pine Woodland and Cypress Forest
Coastal Bluff Scrub
Southern Maritime Chaparral**
Mafic Southern Mixed Chaparral and Mafic Chamise Chaparral
Native Grassland
Oak Woodlands and Broad Leaved Upland Forest
Wetlands**, including Vernal Pools, Alkali Marsh, Freshwater Marsh, Riparian Forests, Riparian Woodlands, and Riparian Scrubs
Maritime Succulent Scrub**

TIER II

Coastal Sage Scrub
Coastal Sage-Chaparral Scrub
Flat-topped Buckwheat

TIER III

Chaparral except for Southern Maritime Chaparral and Mafic Chamise and Mafic Southern Mixed Chaparral
Non-native grassland***

TIER IV (Lands which do not support natural vegetation and which are not regulated by this ordinance)

Disturbed Lands
Agricultural Lands
Eucalyptus Woodland

*Impacts to vegetation communities within the MSCP Subarea shall be mitigated within the MSCP Subarea shown on Attachment A; if mitigation is not feasible within the MSCP Subarea, mitigation may occur on land covered by another approved MSCP subarea plan.

**These vegetation communities require in-kind mitigation.

***Notwithstanding any mitigation ratios set out in Attachment M, non-native grasslands shall be mitigated at the ratio of 0.5 acres of mitigation land for every 1.0 acres of land impacted. Occupied Burrowing owl habitat shall be mitigated according to the Biological Mitigation Ordinance.

Subject	Policy Number	Page
MITIGATION BANKING POLICY	I-117	1 of 8

Purpose

This Mitigation Banking Policy is intended to set forth the procedures to be followed in establishing, using, and managing mitigation banks. This Policy is divided in two sections, as follows.

Section 1: Addresses the issue of establishing and administering County owned and managed mitigation banks.

Section 2: Addresses the issue of recognizing and using private mitigation banks.

This Policy will streamline planning for public and private projects because off-site mitigation credits to meet State and Federal Endangered Species Acts ("ESA") and California Environmental Quality Act ("CEQA") requirements will be readily available. Additionally, this Policy will further the goals of the County Open Space Program by directing mitigation to areas in the County with the highest biological value, resulting in optimal use of the preserved land. Elements of this Policy include the following:

Section 1. County Mitigation Banks.

A. Management framework for overseeing the County's Mitigation Bank Program;

B. Criteria for selecting lands to be included in mitigation banks;

C. Process for establishing credits in mitigation banks;

D. Process for using credits in the bank;

E. Ownership requirements;

F. Land/resource management/assessment of costs;

G. Funding requirements.

Section 2. Private Mitigation Banks.

A. County recognition of private mitigation banks;

B. Process for using credits in the bank.

C. Administration of privately owned banks.

Background

The County of San Diego carries out a variety of projects to meet its goal of serving the public. These include, but are not limited to, road construction and improvement projects; operation and expansion of solid waste facilities, airports, sewage treatment facilities, courthouse administration, building and operation and expansion of detention centers; and construction and improvement of parks. In addition, private development projects for residential, commercial, industrial, recreational, and other purposes are regularly processed through the County. These public and private projects often cause the disturbance of habitat for sensitive species, resulting in the need to mitigate project impacts. A mitigation bank is a technique whereby the County or a private party acquires and manages open space lands for preservation ahead of any need for mitigating a County or private project. Establishment of a County mitigation bank, from which credits may be withdrawn as County projects proceed, will save the County money in mitigation acquisition costs, and will streamline the CEQA process and the granting of approvals under the State and Federal ESAs. Establishing procedures to be followed in using private mitigation banks will likewise streamline the CEQA process for private development projects.

Policy

It is the policy of the Board of Supervisors that:

The County will assemble land within mitigation banks to meet the resource needs of County public projects. The County will also encourage assemblage of land within private mitigation banks.

Section 1. County Mitigation Banks.

A. Management Framework.

The Chief Administrative Officer shall appoint a Mitigation Bank Technical Committee ("MBT Committee") for overseeing the County's Mitigation Bank Program. The MBT Committee shall include directors or their representatives of the Departments of Parks and Recreation, General Services, Planning and Land Use and Public Works. The purpose of this MBT Committee is to review proposals for mitigation banks to determine conformance to the provisions of this Policy and to make recommendations to the Board of Supervisors, and the Chief Administrative Officer, on the establishment and operation of County mitigation banks. The Committee shall select from its members a Chairperson.

B. Criteria.

The following criteria shall be used in selecting the land to be designated and/or acquired as a County mitigation bank:

1. The property should include sensitive and listed plant and animal species. Property that has the potential for revegetation of sensitive habitat may be considered.

2. The property should be large enough to sustain the biological viability of the resources present or should be adjacent to other permanently protected land so that in combination, the biological viability of the resources will be ensured.

3. The property should contribute to implementation of the County Open Space Planning efforts where adopted or be identified as high value areas on resource evaluation maps.

4. For property which is to be acquired by the County for a County owned mitigation bank, the property owner must be willing to sell or donate the property to the County.

The following types of property shall not be considered for mitigation banking purposes:

1. Property previously designated for park use or open space purposes; property acquired in the past for mitigation purposes; property designated for a public purpose which is not consistent with habitat/resource protection, ie: Circulation Element right-of-way, or Solid Waste Facility.

2. Property in County ownership which was acquired with funds limiting the use of the property to certain purposes. Examples include property acquired with the road fund and park property acquired with State Bond Act funds, which restricts the use of the land.

C. <u>Process for Establishing Credits in County Banks</u>.

1. Property currently in County ownership or control will be evaluated by the MBT Committee based on the criteria set forth in Section 1. B. above, for potential inclusion in a mitigation bank. An environmental review of the resources present on the site should be performed, and a report generated which includes information on the baseline environmental data (type, quality, extent and location of resources) on the property. The amount of credit to be granted in a bank shall be determined based upon negotiations with the U.S. Fish and Wildlife Service and the California Department of Fish and Game ("the Wildlife Agencies"), using guidelines set forth in the Official Policy on Conservation Banks, adopted April 7, 1995 by the California Resources Agency and the California Environmental Protection Agency. Credits shall be based on the location of the property and resources present on the site. Once the property has been determined by the MBT Committee to be appropriate for inclusion in a bank, and an estimated number of credits determined, the Department of Planning and Land Use should develop a mitigation banking agreement ("Agreement"), in a form approved by County Counsel, and should negotiate the terms of such Agreement with the Wildlife Agencies. The Agreement shall set forth the number of credits available for the property proposed for inclusion in the mitigation bank and a management plan for the property. The Agreement shall be approved by the Board of Supervisors.

2. Each County department shall maintain a list of public projects planned for the upcoming five years. An estimate as to the type and amount of habitat likely to be disturbed by the project should also be prepared. A master compilation of this list shall be maintained by the Department of Planning

and Land Use. If the County owned bank is exhausted, or the bank does not contain credits of the type needed for a future County project, property should be acquired for mitigation banking purposes, using criteria set forth in Section 1. B., above. Prior to seeking property for inclusion in the bank, the master list of future projects should be consulted to determine what type of habitat to purchase.

3. In acquiring property for County owned mitigation banks, the County will rely on acquiring properties from willing sellers and will not use the power of eminent domain. Once a suitable site for acquisition by the County is found, an environmental review of the resources present on the site should be performed, and a report generated which includes information on the baseline environmental data (type, quality, extent and location of resources) on the property. The amount of credit to be granted in a bank shall be determined based upon negotiations with the Wildlife Agencies, using guidelines set forth in the Official Policy on Conservation Banks, adopted April 7, 1995 by the California Resources Agency and the California Environmental Protection Agency. Credits shall be based on the location of the property and resources present on the site. Informal agreement as to the number of credits available should be reached with the Wildlife Agencies prior to requesting authorization from the Board of Supervisors to purchase the site. Purchase of the site should be contingent upon approval of an Agreement, in a form approved by County Counsel, by the Wildlife Agencies and the Board of Supervisors.

D. Process for Using Credits in the Bank.

The Department of Planning and Land Use shall be responsible for administering and accounting for the credits created by County Mitigation Banking Agreements.

County departments shall analyze their need for mitigation for a project early in the environmental review process. Once the need for mitigation for a particular project is known, the project planner/manager shall contact Planning and Land Use to determine whether credits are available in a County owned mitigation bank to satisfy the project mitigation requirements.

Use of mitigation credits from mitigation banks must be approved by the County discretionary body responsible for certifying/approving the necessary environmental documents for the project, with concurrence from the Resource Agencies. The Department of Planning and Land Use shall be notified when a project has been approved which utilizes credits from a County mitigation bank. The Department of Planning and Land Use shall be responsible for the record keeping task of debiting credits from County mitigation banks as projects are approved.

County Departments shall not be bound to purchase credits from a County mitigation bank when fulfilling the requirement for mitigation of the impacts of a project. If it is appropriate and in the best interests of the County, the County may purchase credits or land from a private bank.

E. Ownership Requirements.

Mitigation banks must be maintained in perpetuity. Title may be held in fee by the County, the Wildlife Agencies or another entity authorized in the Mitigation Bank Agreement. For banks held in fee by the County, the Wildlife Agencies require that the County grant an open space easement over mitigation bank property either to a non-profit organization which has as its primary purpose the preservation, protection or enhancement of land in its natural, scenic, forested or open space condition or use, or to the State Department of Fish and Game, or any district or other state or local governmental entity if otherwise authorized to acquire and hold title to real property.

F. Land/Resource Management/Assessment of Costs.

Management of resources present in the mitigation banks is necessary in order to maintain the bank's habitat value. Before property is acquired for a County mitigation bank, a management plan for the property shall be prepared under the direction of the Department of Parks and Recreation and approved by the MBT Committee. The goal of the management plan shall be to maintain the property, and the resources present on the property, as a viable habitat, in perpetuity. The management plan shall include, but not be limited to the following:

- Baseline environmental data (type, quality, extent and location of resources on the property).

- A description of the number of credits available.

- A description of the access control measures to be taken.

- A description of the vegetation management techniques appropriate to the resources.

- A listing of any reporting requirements established by the Resource Agencies.

- An estimate of the start-up and annual costs for administration and management activities, including an estimate of the amount necessary to capitalize a trust account to support the bank in perpetuity.

- Any other management activity specifically required in order to maintain the resources in their present condition.

The management plan for County mitigation banks should be approved by the Resource Agencies, and included in the terms of the mitigation banking agreement identified in Section 1. C., above. The management plan shall be administered under the direction of the Department of Parks and Recreation, unless another agency has been designated by the Board of Supervisors to administer the management plan for County mitigation banks. Based on the resources present, size and location of the bank in relation to other open space lands managed by the County, management activities may be carried out directly by County staff or under contract with a private resource manager. The cost of the preparation of the management plans should either be included in the planning costs of a County project requiring the establishment of a bank or as part of the annual Department of Parks and Recreation budget. This determination will be made by the Board of Supervisors during the annual budget process.

G. Funding Requirements/Cost of Credits.

For County projects, costs associated with the mitigation bank will be borne by the Departments which initiate the projects ultimately using credits in a Bank. Based on the information obtained from the management plan referenced above, a trust account will be established by Auditor and Controller to fund the management and administration of the bank. Interest from the account will be used to fund administration and management costs. If an enterprise fund was used to initially establish a mitigation bank, as credits are allocated to County projects, a prorated amount for the initial capitalization shall be paid to the account that originally established the trust fund. A separate Resource Replacement Fund be established for replacing the resource value of banks as they are credited to projects through either buying additional lands or credits in private banks. The purchase of each credit should include a contribution to this replacement fund in addition to contributing to the operation and maintenance fund. The MBT Committee shall determine the credit cost per unit.

Section 2. Private Mitigation Banks.

A. County Recognition of Private Mitigation Banks.

The County will rely upon the Wildlife Agencies and private individuals for the establishment of private mitigation banks. The Official Policy on Conservation Banks sets forth standards and criteria for establishment of private mitigation banks. This Policy requires an agreements between the bank developer and the appropriate regulatory agency(s). The Official Policy provides for assuring biological viability, resource protection, resource management, and establishment of credits. Prior to the approval of a bank in the unincorporated area by the State of California, the County will request that it be notified and allowed to review the proposed bank and comment on the conformance of proposed banks with this policy (Section 1.B.1-3). The MBT Committee shall review and comment on each proposal for a private mitigation bank within 30 days of the receipt of the request. The County shall rely on the Wildlife Agencies to require and approve management plans for private mitigation banks.

The County will also request the State to provide the County with a list of approved banks in the San Diego region which the County will make available by posting to agencies and private individuals needing mitigation credits.

B. Guidelines for the Use of Mitigation Credits from Private Mitigation Banks for Private Projects.

When a project proposes to use mitigation credits from a private mitigation bank, the Department of Planning and Land Use shall verify the bank has a valid mitigation bank agreement approved by the Wildlife Agencies. The privately owned bank owner/manager and project proponent shall also be required to provide to the Department of Planning and Land Use an accounting of the available mitigation bank credits.

The Department of Planning and Land Use shall review the proposal for use of mitigation credits and shall submit a recommendation on the use of such credits to the approving authority. Use of mitigation credits shall be reviewed and approved on a case by case basis.

C. Administration of Privately Owned Banks.

Responsibility for administration of privately owned mitigation banks shall be established and monitored by the Wildlife Agencies as a requirement of mitigation banking agreements.

Costs associated with the use of privately owned mitigation banks will be addressed in a manner consistent with the terms of the mitigation bank agreement approved by the Wildlife Agencies.

Board Action

10/4/95 (2)

Sunset Date

12/31/03

1. Department of Planning and Land Use
2. Department of Parks and Recreation
3. Department of Public Works
4. General Services

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ATTACHMENT M

TABLE OF MITIGATION RATIOS*

TIER I	*Impacted land*	
*Mitigation Site**	meets criteria for biological resource core area	does not meet criteria for biological resource core area
meets criteria for biological resource core area	2:1	1:1
does not meet the criteria for biological resource core area	3:1	2:1

TIER II	*Impacted land*	
*Mitigation Site**	meets criteria for biological resource core area	does not meet criteria for biological resource core area
meets criteria for biological resource core area	1.5:1	1:1
does not meet the criteria for biological resource core area	2:1	1.5:1

TIER III	*Impacted land*	
*Mitigation Site**	meets criteria for biological resource core area	does not meet criteria for biological resource core area
meets criteria for biological resource core area	1:1	0.5:1
does not meet the criteria for biological resource core area	1.5:1	1:1

*Impacts to vegetation communities within the MSCP Subarea shall be mitigated within the MSCP Subarea shown on Attachment A; if mitigation is not feasible within the MSCP Subarea, mitigation may occur on land covered by another approved MSCP subarea plan.